SCIENTIFIC AMERICAN

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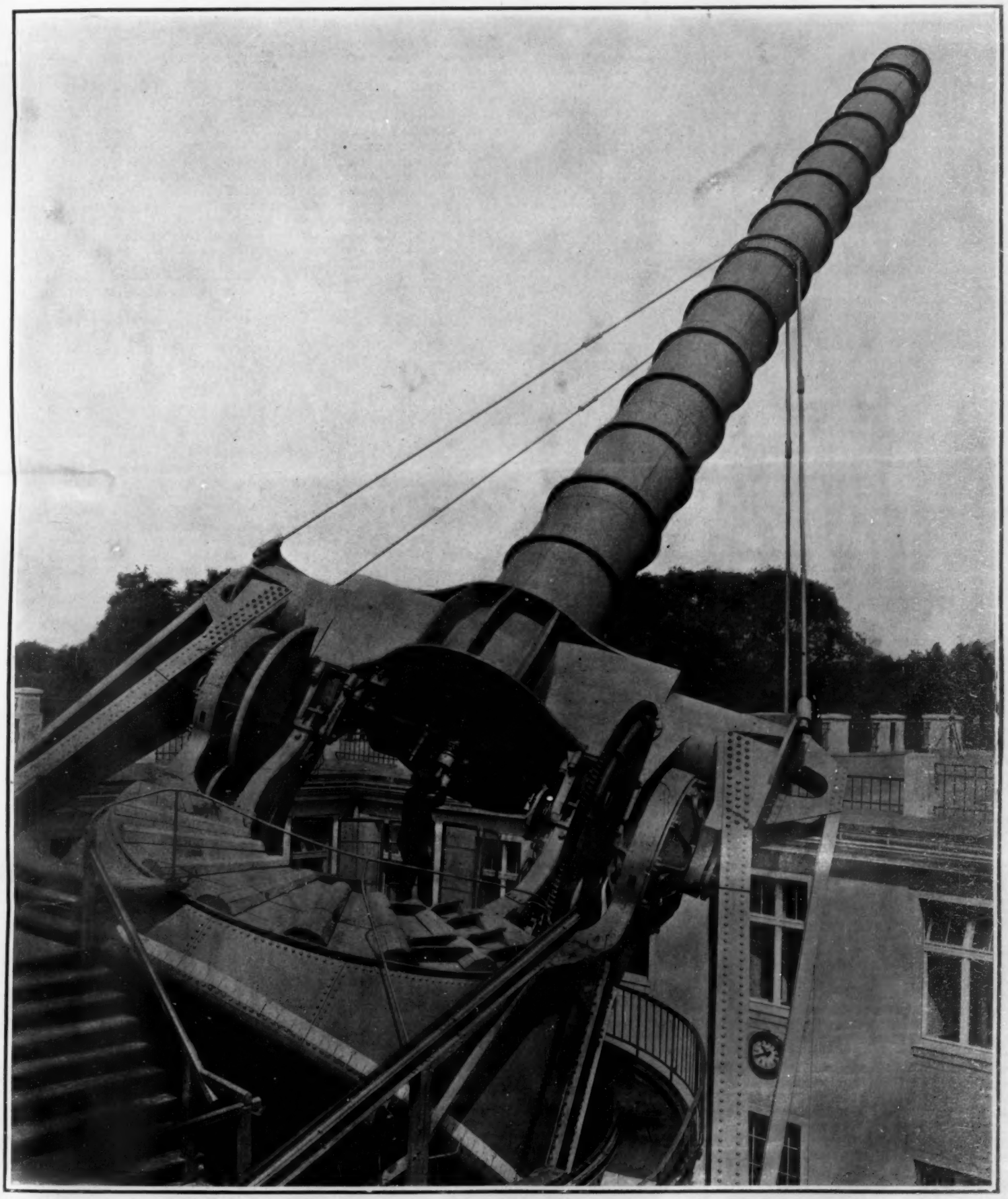

The longest telescope in the world, at Treptow (near Berlin) Focal length, 69 feet; lens, 27 inches in diameter.

A GREAT OPEN-AIR TELESCOPE.—[See page 104.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, JANUARY 29th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

WAVE VERSUS SHIP.

WAS it a last despairing protest of Old Ocean, when he lifted his giant hand in the blackness of the night of January 10, and smote the "Lusitania" a blow which racked and splintered her lofty bridge and pilot house, 75 feet above the sea, and crushed down her forecastle deck and decks beneath, giving them a permanent depression of several inches? For time was, and not so very long ago, when the sea was the undisputed master of the ship, and whenever Neptune saw fit to open the vials of his wrath, and send his league-long rollers across the deep, the proudest ship of the day must needs stop at his bidding, if she did not indeed turn and run before the fury of the blast. Of late years, man, by virtue of his knowledge and mechanical skill, has been building in ever-increasing lengths and breadths, and with such ceaseless enlargements of bunker and boiler room—he has so multiplied horse-power, and has called to his aid so many ingenious contrivances for speed and strength and safety, that old Neptune must for many a decade past have foreseen the humiliating day, when he could no longer hold the destinies of the bold sea voyager in his hand, and no longer say to him "Thus far, and thus slowly shalt thou go."

Following the hint of ultimate victory, which was supplied by the "Lusitania" and "Campania," came that wonderful ship of the Hamburg-American Line, the "Deutschland," and the even larger and more powerful "Kaiser Wilhelm" and "Cecilie" of the North German Lloyd; and with the advent of each giant vessel, man's growing mastery of the ocean was shown in ever-increasing speed, and a closer approximation in times of departure and arrival to the regularity of transportation on land.

It was reserved for the steam turbine to supply the last mechanical device which was to give to man in his age-long struggle with the elements a weapon of complete victory; for in the combination of size and strength and power afforded by the latest turbine liners there has been developed a ship which has demonstrated its ability to drive at full speed and all day long into the heaviest seas that the stormy North Atlantic could pile across her path. The writer will not soon forget a notable day, some two winters ago, when the "Lusitania," in weather which varied from a gale to a full hurricane, averaged for the twenty-four hours a speed of between twenty-six and twenty-seven land miles an hour. During the tumult of that tremendous struggle, ten-ton anchors were shifted, it is true, and steel derrick booms were swung athwartship and twisted as if they were no stouter than a boy's tin whistle. Yet the ship steamed into port practically intact, and with not a rivet started in the whole fabric of her hull.

Ordinarily a transatlantic liner will drive her way against a westerly gale, voyage after voyage, with no more serious hurt than the bending of a stanchion or the breaking of a pane of glass in the pilot house. But, once in a long while, there may come a combination of seas which are so related to the length of the ship, that she may be riding down one wave, with her bow buried deep, and her forecastle deck awash, just as her stem drives into a roller, steep of front and of vast height. Then it is that the structure of the ship meets its moment of supreme trial; and not even the officers, 75 feet above water, are safe from the full impact of a solid Atlantic sea.

On the Monday night in question, because of the tempestuous weather, the glass windows in the pilot house had been lowered and the storm windows, built of solid wood, with a small heavy glass port light in the center, had been raised. The stern of the vessel was lifting high on a receding sea, and the forecastle deck was awash, just at the moment that a wave of gigantic proportions loomed up at the bow. From the fact that the solid water swept entirely over the pilot house and the compass stand upon its roof, which latter is at least 80 feet above the normal waterline, this wave must have been some 35 feet high measured from the trough. The sea was breaking, and therefore the mass of water must have had considerable forward momentum. The ship itself was running at half speed, and met the sea at a speed of from twelve to thirteen knots. When the mass struck the breastworks and pilot house, every one of the stout wooden storm windows was burst in, the woodwork being stripped clean to the sashes, and the stout steel framing between the windows was forced several inches into the pilot house. The sea swept onward, driving a piece of the woodwork bodily through a hardwood casing containing a portion of the fire-fighting apparatus. The quartermaster was borne back against the bulkhead behind, carrying in his hands the wheel which was torn from its standard. The mass of water then swept into the officers' ward-room and staterooms, filling them breast high with water—and this, be it remembered, at an elevation of 75 feet above the normal sea level.

Now, since the ship is some 80 feet broad at this point, and the distance from the pilot house to the stem must be at least 150 feet, and since, in order to roll over the pilot house, the waves must have been some 35 feet in height, at least 4,000 tons of water must have swept over the forecastle deck—as anyone with a pencil and pad may easily figure out for himself. It cannot be possible that the wave fell with much vertical impact, or the decks would have crumpled up like an egg-shell; but the momentum was sufficient to crush the forecastle deck and the three decks below a few inches down into the body of the ship, leaving them with a permanent set. Dramatic evidence of the enormous stresses to which the ship was subjected is afforded by the stanchions and solid steel bulkheads below the deck, which, in some places, buckled out of the vertical as they yielded beneath the load above. Had the "Lusitania" not been built of special strength to stand such buffeting as this, the results might easily have been very serious indeed; and we are inclined to agree with her captain in his belief that many smaller and less stoutly built ships, which have disappeared utterly at sea, may have been sent to the bottom by the crushing in of their decks under so-called "tidal waves" of these dimensions.

INDUSTRIAL FELLOWSHIPS IN UNIVERSITY WORK.

THE University of Kansas has inaugurated a system of Industrial Fellowships, which is based upon a broadly similar practice that has already been followed to some extent in Europe. Some three years ago Prof. Duncan of the Department of Industrial Chemistry directed the attention of manufacturers to the necessity for greater technical efficiency, and suggested that this might be promoted if the manufacturing interests in the field of industrial chemistry co-operated with the universities by establishing fellowships for research in certain specified directions. At the present time eleven fellowships have been established of which eight are now in operation. A full discussion of the scheme will be found in the current issue of the SUPPLEMENT; but the general scope of the movement may be gathered from a consideration of the following fellowships which are among those which have been already established:

A Fellowship for an investigation into the chemistry of laundering, with a view to saving laundered fabrics; $500 a year with 10 per cent of the profits.

An investigation into the Chemistry of Baking, established by the National Master Bakers' Association, with the object not only of improving the chemistry of bread but of providing for the association of a trained expert on whom they could thereafter rely; $500 a year together with a sum to be settled by arbitration.

An investigation into the relation between the optical properties of glass and its chemical constitution; $1,500 a year and 10 per cent of the profits.

The discovery of new utilities for ozone; $2,000 a year and 10 per cent of the profits.

The general form of the agreement calls for an investigation to which the holder of the fellowship gives his whole time and attention, with the exception of three hours a week, which he devotes to work of instruction in the Chemical Department of the University. The Fellow, who is appointed by the chancellor and other officers of the university, must have a reputation in research; must be a member of the university; must work under the direction and advice of the Professor of Industrial Chemistry; and must forward through him to the industrial company, the donors of the fellowship, periodical reports of the progress of his work. All discoveries made by the fellow during the tenure of the fellowship become the property of the industrial company, subject to the payment to the fellow of 10 per cent of the net profits. In the event of any disagreement between the donors and the holder, the chancellor of the university, or his appointee, is mutually accepted as arbiter.

The advantages accruing from these fellowships, according to Prof. Duncan, are that the university gains increased opportunities for promoting research; that it obtains three hours a week of gratuitous and skilled instruction; that the manufacturer obtains the advantages of vastly increased laboratory facilities and full library facilities (for lack of which factory research has been most seriously hampered in the past) that the manufacturer has consultative advantages, since the fellow appointed is at liberty to question specialists in the different fields of chemistry; that the manufacturer is freed from supervision of the work of research; and that on the termination of the fellowship he obtains, if he so desires, the services of a man educated to this particular need. As regards the fellow, he co-operates in the advantages above ascribed to the manufacturer; he obtains an inside knowledge of factory processes; and he is freed from the petty interferences and jealousies of shop employees and the "pot shop" judgments of factory officials. Moreover, if he makes good, he obtains a position for which his training during the fellowship renders him peculiarly qualified.

Finally, since at the end of the three years' term, all work done under any fellowship must be published free to the public, the latter becomes one of the most important beneficiaries of the new system. The insertion of this last clause was at first resisted by some of the manufacturers; but in the end the donor, when it was pointed out to him that a really progressive manufacturer would find that three years would give him a sufficient start of competitors, withdrew his objections.

THE MOON AND RADIO-ACTIVITY.

THE probable influence of the moon's movement upon the radio-activity of the air is brought out by M. Paul Besson in a paper presented to the Académie des Sciences. We find that different authors show great variations in the radio-activity of the air, and M. Besson concludes that this radio-activity comes from the ground, as Elster and Geitel also suppose. He made experiments in the summer of 1908 and 1909 and showed that the variation in the activity of mineral water varied with the atmospheric pressure, being highest when the pressure lowered. Other authors observed the same fact. When the barometer descends the emanation from the soil increases, and the contrary. But he noticed other variations which were unaccounted for, and thought that they might come from the tidal movement of the earth's crust, which was shown in a striking way by M. Charles Lallemand of the Bureau of Longitudes. When the moon passes the meridian it causes a tidal wave in the earth's crust, and the emanation from the soil is maximum at this moment, and *vice versa*, at least as may be supposed. The author's observations lead to the following conclusions: As regards atmospheric pressure alone, for a one-hour test which is constant with relation to the moon's passage at the meridian and thus excluding the moon's influence, the radio-activity increases when the atmospheric pressure decreases, as above noted. As to the influence of the moon, we find that at a constant barometric pressure, the activity is maximum for the passage of the moon at the meridian and minimum for the passage at the other side. The author hopes to make a more complete series of observations in order to establish his hypothesis. If the law of variation of the emanation coming from the earth could be established, we would ascertain the principal cause of the variation of the air's radio-activity. Should it be found that the moon's movement caused changes in the radio-activity of the air, we would have the proof that the moon has an influence on the changes of weather, according to the popular belief, this being caused by multiplying or lessening the centers of condensation of water vapor, outside of air pressure effects and others.

Mr. T. H. Svedberg has succeeded in obtaining by ultra-violet radiations, colloidal solutions of various metals in different liquids. The metal to be pulverized should be perfectly freed of any surface oxides. After being covered with the solution in a flat bowl, it is exposed from above to the radiations of a quartz glass mercury lamp. After a few minutes the liquid, when observed in the ultra-microscope, shows the characteristic aspect of a colloidal solution. Different metals and solutions show a rather different behavior. Thus silver, copper, tin and lead were found to be quite readily pulverized colloidal solutions, whereas platinum, aluminium, and cadmium show only a very slight, if any, pulverization. The experimenter carried out investigations with lead and silver not only in water, but in a number of other solutions, and showed that the magnitude and number of particles may be very different, according to the conditions of the case, pulverization being dependent on the nature of the solvent.

ENGINEERING.

We note that the Indiana State Railway Commission has recently issued an order requiring that all locomotives except those that are engaged in switching be equipped with headlights of not less than 1,500 candle-power.

A train consisting of 120 coal cars, each carrying 55 tons of coal, was recently hauled a distance of 125 miles over the Virginian Railway in 8 hours, 11 minutes. The locomotive, which is of the Mallet type, weighed, with the tender 481,000 pounds, and the total weight of the train was therefore over 9,100 tons.

In view of the continual improvement which is taking place in the marine turbine the outlook for the early installation of the marine gas engine in ships of large power is not very promising. Perhaps the future of the latter lies in the direction of small high-speed engines generating current to be used on slow-speed electric motors direct connected to the propeller shafts.

In the recent placing of a memorial window in Westminster Abbey to Sir Benjamin Baker, a fitting tribute was paid to a great engineer, and a precedent was established which in this age of technical achievements must meet with universal approval. The tablet reads: "In Memory of Sir Benjamin Baker, Civil Engineer, Forth Bridge, Assouan Dam, B. 1840, D. 1907." It is probable that the series of windows, of which this forms one, will be reserved for commemoration of other famous engineers.

The warship has already surpassed the ocean liner in speed and she is rapidly overtaking her in size. The new British armored cruiser "Lion" will be about as long as the "Oceanic" and of the same beam as the "Mauretania." At full speed, propelled by 70,000-horse-power turbines, she will make from 29 to 30 knots. With her eight 12-inch guns carried high above the water line, her four smokestacks and two tripod masts, this great ship will certainly present a most formidable appearance.

The really extraordinary increase in the power of reciprocating engines due to utilizing the exhaust in a low-pressure turbine will be understood when it is borne in mind that in expanding steam from say 150 pounds to a 28-inch vacuum, over 90 per cent of the expansion and over 40 per cent of the reduction in temperature occur below atmospheric pressure, or say, from about one pound gage to about one pound absolute. It took the low-pressure steam turbine to recover the heat energy thus lost in the exhaust.

We understand that the British government is favorable to the construction of a ship canal across Scotland from the Firth of Forth by way of Stirling, Loch Loman, and Loch Long, to the Firth of Clyde. The plan proposed calls for 35 miles of lake navigation. It is estimated that the work can be completed in nine years at an expenditure of about $100,000,000. If the canal be built to conform to naval requirements of a minimum depth of 36 feet and bottom width of 148 feet, with locks to match, the government will be prepared to co-operate with private enterprise.

The improvement in roadbed, rolling stock and protective signaling on American railroads is shown by the Bureau of Railway News of Chicago, whose returns show that 340 roads operating over 153,000 miles of railway have not killed a passenger during a period of one year. It is true that toward the close of 1909 there was one of those curious epidemics of accidents which cast a shadow over this record; but the immunity mentioned above shows how vastly we have advanced over conditions of ten or fifteen years ago.

A contract has been let for the removal of the fallen portion of the Quebec Bridge which now lies in a tangled mass upon the south shore of the river. According to press reports the steel is to be severed for removal by means of a mechanical cutter; but we do not place much credence in the statement, for the reason that the obviously ideal method would be to use the oxy-hydrogen or oxy-acetylene flame, whose apparatus is so portable as to render it ideal for setting up in the many difficult positions which would be necessary.

Comparative tests of consolidation and Mallet locomotives over mountain grades on the Southern Pacific Railway, under similar conditions of service, have shown all round economies in favor of the Mallet compound over the simple high-pressure locomotive of the standard type. The Mallet locomotive evaporated 7.81 per cent more water per pound of fuel, showed 14.04 per cent more ton miles per gallon of water used in the main cylinders, and 22.50 per cent more ton miles per pound of oil burned, and because of its greater size and power hauled 119.54 per cent more tonnage. The economy is due to the re-heating of the steam, the heating of the feed water, and compounding. The re-heater and feed water heater reduced the smokestack temperature of the gases from 738.5 degrees in the simple engine to 451.3 degrees in the Mallet type.

ELECTRICITY.

Among the most important advantages of the "Pay-as-you-enter" car is the fact that these cars are safer to passengers getting on and off and fewer accidents occur from persons stealing rides. Statistics have been compiled for the Chicago railroads which show that since "Pay-as-you-enter" cars were installed the number of accidents has been reduced 31.9 per cent.

A recent report of the American Telephone and Telegraph Company shows that at the end of 1909 the Bell companies owned 3,500,000 telephones, while 1,500,000 were owned by companies under contract agreements with the associated Bell companies. This is an increase of 600,000 telephones during the year. The system comprises 10,250,000 miles of wire, 400,000 miles of which were added last year. Half of the total mileage is underground.

A test of Thomas A. Edison's storage battery car was recently made at West Orange, N. J. The car is 26 feet long and weighs 5 tons. It was fitted with two 7½-horse-power motors, and the operating cost is estimated at one cent a mile. During the test the car was operated at a speed of twenty miles per hour. The motors are operated at 110 volts, and it is claimed that a run of 150 miles can be made without recharging the batteries.

It has been reported that the Illinois Tunnel Company of Chicago is about to establish a system comprising 20,000 telephones, which will be operated in competition with the present telephone system of the city. The new system will make connections with long-distance independent lines. The Tunnel Company put in a system of automatic telephones ten years ago, but these are to be discarded and replaced with new and up-to-date apparatus.

Metal filament lamps are now being used on ships and railroad cars. Such uses were considered impossible a few years ago, owing to the frailty of the long filament required in these lamps, and it was supposed at the time that they could never be used anywhere but on a fixed support and hanging downward. Now the filaments are so much stronger that in a recent railroad wreck the metal filament lamps in a car that was completely overturned were found to be in perfect condition and fit for further use in the regular service.

At a recent meeting of the New York Electrical Society one of the speakers, lecturing on the subject of domestic electricity, referred to a certain house that had been designed to be heated and lighted by electricity alone. The house contains no chimneys, stoves or coal storage room, and the saving in these requirements of the usual coal-heating system was sufficient to pay for the entire electrical installation. In regions where the cost of coal is high and water power is plentiful electric heating and lighting is no doubt more economical than coal heating.

One of our large electric illuminating companies has found a new field for the consumption of electricity, namely, the Chinese laundry. A Chinaman was induced to equip his shop with an electric washing machine and electric irons, and the photograph of this enterprising Oriental with his electrically equipped shop is being sent around among Chinese laundrymen, together with a letter written in Chinese calling attention to the advantages of modern methods in the laundry business. It will be interesting to watch the success of this experiment.

A carefully tabulated record of the cost of electric wagons and horse rigs used by the Commonwealth Edison Company of Chicago has just been published. It shows conclusively that the electrically operated wagon is cheaper than the horse drawn vehicle and when we add to this advantage the fact that it makes a better appearance, is handier, and can cover ground in less time, enough has been said to show that the electrically operated wagon is far superior to the horse drawn vehicle and will undoubtedly displace it. Attention should also be called to the fact that the cost of the horse drawn rig is increasing each year, particularly because of the rise in the price of feed.

A thunderstorm observatory has been established in Spain by Senor G. J. de Guillen Garcia, in which atmospheric discharges, both local and distant, are detected graphically and acoustically. A wireless telegraph instrument is used for this purpose, because each lightning discharge is accompanied by electromagnetic waves similar to those used in wireless telegraphy. If there is a storm anywhere within a radius of 500 miles the observer is notified of the fact by the recording instrument. As all barometric depressions that pass over Western Europe come from the Atlantic Ocean, the new observatory gives meteorologists due warning of the approaching disturbance. By noting the intensity of the sounds produced in the receiver and observing whether they grow more distinct or less, it is possible to determine the approximate course of the storm.

SCIENCE.

Lieut. Ernest H. Schackleton has announced that he will enter upon another Antarctic expedition. The date of the expedition has not as yet been decided.

The Brooklyn Public Library has published a little pamphlet on "Aeronautics or Aerial Navigation," which comprises a list of books and references to periodicals in the Brooklyn Public Library on the subject of aeronautics. The list is fairly complete, and may be regarded as an excellent bibliography of a most timely subject.

A tyrannosaurus has been placed on exhibition in the Dinosaur Hall of the American Museum of Natural History. This dinosaur measures 40 feet in length. The jaws of the massive skull are four feet long and are armed with sharply-pointed teeth. Tyrannosaurus was probably the largest carnivorous animal that ever roamed the earth.

The Scott expedition in search of the South Pole is now assured. The British government has promised $100,000 toward the $200,000 which is the estimated expense. A total of between $55,000 and $60,000 has been raised by public subscription. In all likelihood the expedition will start in July. Capt. Scott commanded the British Arctic expedition of 1900-1904. Shackleton was one of his lieutenants.

Many attempts have been made to use old newspapers and other printed sheets in the manufacture of white paper, but the removal of the printers' ink from the fiber has hitherto presented an insuperable difficulty. In a process recently patented in Germany the paper pulp is treated with alkaline solutions of peroxides of the metals of the alkalis and alkaline earths, which so alter the greasy part of the ink that it ceases to bind the lampblack and other pigments, which are then easily separated from the fiber by emulsifying the pulp with gelatinous silica.

An international agreement for the prohibition of the use of saccharine has been instigated by the French government. Favorable responses were received from Germany, Austria-Hungary, Belgium, Greece, Italy, the Netherlands, Portugal, Russia, and Switzerland, and a meeting of delegates from these countries was held in Paris, under the presidency of the French minister of foreign affairs. The commission closed its session on November 19th, with the adoption of a formal prohibition of the use of saccharine in foods and beverages. The French government will transmit this prohibition to the governments of the other countries, for ratification.

A recent German patent describes the preparation of a casting mass composed of slaked lime and water, with small quantities of alkali and a carbohydrate. 100 parts of a stiff paste of well-slaked lime, containing approximately equal amounts of lime and water, are mixed with 1 or 2 parts of a carbohydrate free from water, such as gum arabic, dextrin or sugar, and an equal quantity of a potash or soda salt which is decomposed by lime. The mixture becomes as fluid as if a large quantity of water had been added to the lime, but soon solidifies and retains the form of any mold into which it is poured. If about 2 parts of cellulose, wood pulp or other fibrous material are added, good imitations of wood and ivory can be made.

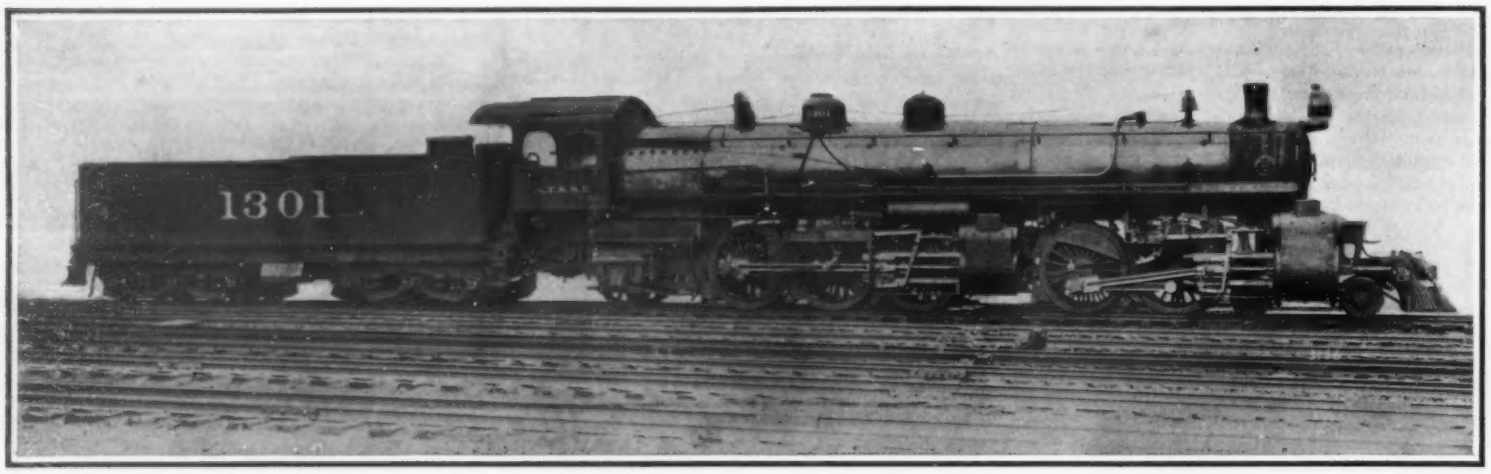
The investigation of the spectra of the planets, which was begun at Lowell Observatory in 1902, has been continued. The result of recent work is given by V. M. Slipher in a bulletin just issued. Slipher found a combination of dyes which renders the sensitiveness of the commercial dry plate fairly uniform into the red as far as to wave length 7,000, beyond which point it drops rapidly, but is sufficient at A to record faintly that line in the prismatic solar spectrum. With the aid of this plate, the spectra of Jupiter, Saturn, Uranus, and Neptune have now been photographed with greater extension into the red than any previous photographic or visual observations, and a number of lines and bands have been discovered.

The beet is one of the most valuable of cultivated plants. The red garden varieties furnish savory table vegetables, the large forage beets form an excellent food for cattle, and the sugar beet is one of the principal sources of sugar and alcohol. The usefulness of this valuable root has now been increased by the production of an edible flour from sugar beets. The desiccation of sliced sugar beets (Zuckerschnitzel) is already practised in Germany on a very extensive scale, but the product is employed exclusively as fodder for cattle. In Belgium, however, a meal is now made from dried beets which, according to a paper read before the recent chemical congress in London, is entirely free from the distinctive flavor of the beet and is suitable for use in making cakes, puddings, and pastry. As it contains about 65 per cent of sugar, it can often be substituted, with advantage, for sugar, in somewhat larger quantities. The processes of desiccation and grinding not only cost less than the extraction of sugar, but preserve all the sugar of the beet, part of which is rejected in the form of molasses, in the process of sugar making.

A NEW ERA OF THE AMERICAN LOCOMOTIVE

TWO REMARKABLE ENGINES

It is not stretching the point too far to say that the design of the locomotives herewith illustrated, one for passenger and the other for freight service, marks a new era in the development of the American steam locomotive. This is particularly true of the passenger locomotive, with which, by the introduction of the Mallet articulated piston, it has become possible to haul heavy fast passenger trains which, with the present type of locomotive, it is necessary to run in two sections. Moreover, so powerful is this engine that it can haul over the heavy grades of the mountain divisions transcontinental trains which at present call for the assistance of an extra locomotive.



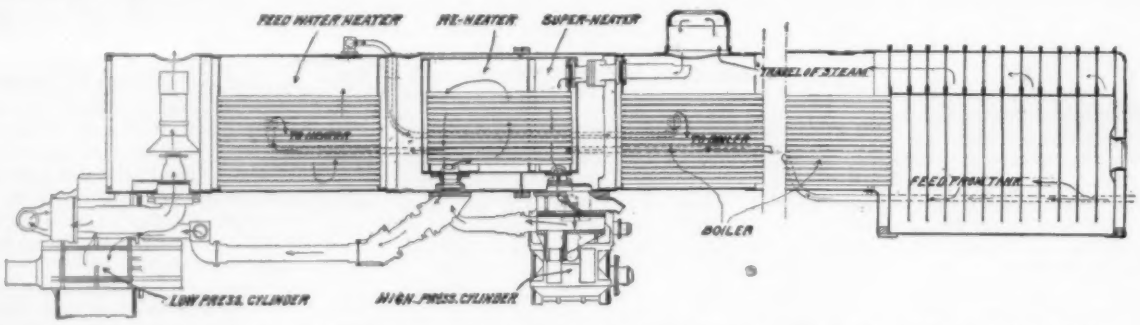
Weight of engine and tender, 305 tons. **Tractive force,** 36½ tons. **Heating surface,** 4,756 square feet. **Steam pressure,** 200 pounds. **Superheating and reheating surface,** 1,121 square feet. **Cylinders:** Two high-pressure, 24 inches by 28 inches; two low-pressure, 38 inches by 28 inches. **Driving wheels,** 73 inches.

The most powerful passenger locomotive in existence.—A new type

The Mallet articulated freight locomotive is already familiar; but the claim to distinction of the truly mammoth affair recently built for the Santa Fe Railroad is based on its great weight of 350 tons and its tractive force of 54 tons, both of which figures greatly exceed those for any previous freight locomotive. Both locomotives were built by the Baldwin Locomotive Works for the Atchison & Santa Fe Railroad.

The most important novelty, common to both engines, and the one which marks a distinctly new era in locomotive practice in this country, lies in the means which have been taken to transform the locomotive from one of the most wasteful into a reasonably economical power plant (if we may use the term). This has been done in both engines by utilizing the great length of boiler space afforded by the articulated system of construction. As will be seen from our sectional view, the boiler proper terminates above the high-pressure cylinders. The shell, however, is extended forward to the low-pressure cylinders, and within it are placed two nests of fire tubes, through both of which the hot gases pass on their way to the smokestack. The first of these is divided by a diaphragm into a super-heater and a re-heater; the second forms the feed water heater.

Now, in the ordinary locomotive the gases, still very hot, after emerging from the front end of the fire tube, pass out through the smokestack and waste an enormous amount of useful heat into the atmosphere. The Santa Fe locomotives return a large part of this heat to the boiler and engine. Referring to the diagram, it will be noticed that these heat-recovery devices first serve to raise the temperature of the steam as it passes from the steam dome to the high-pressure cylinder. Then the gases yield up still more of their heat to the exhaust steam as it passes from the high-pressure to the low-pressure cylinders, the heat so taken up by the steam serving in each case to raise the heat energy of the latter. Finally the gases pass through a large nest of tubes, around which the feed water is caused to circulate and is raised to the boiling point, as it travels from the tank on the tender to the boiler.

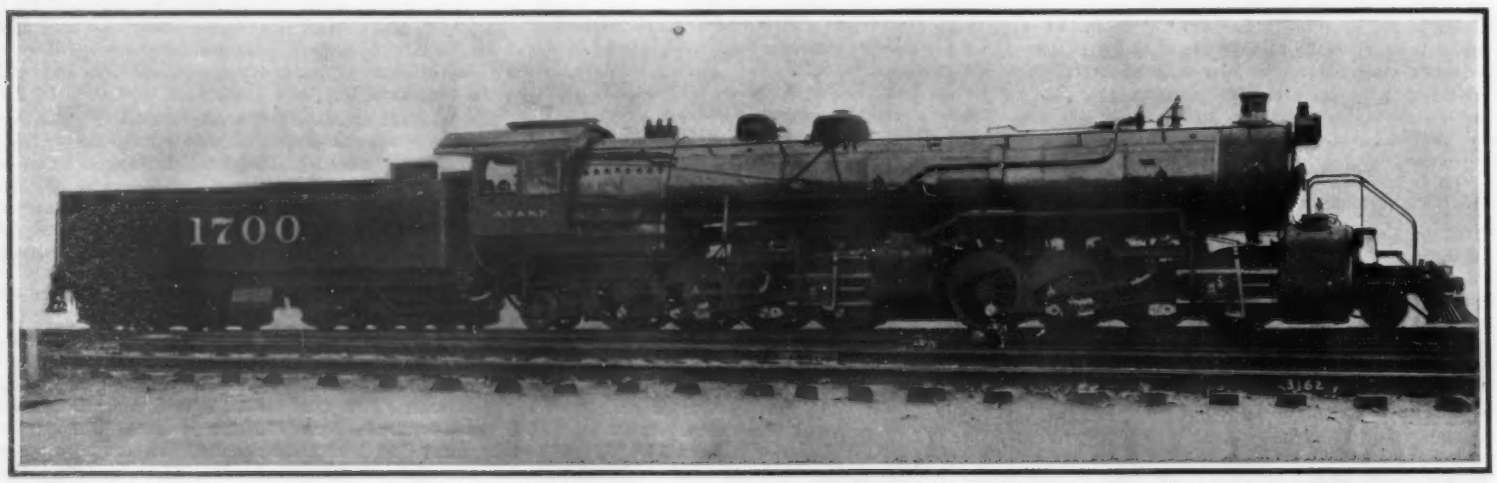


In this boiler part of the heat in the furnace gases which is ordinarily lost through the smokestack, is utilized to superheat and reheat the steam on its way to the cylinders and to heat the feed water before it enters the boiler.

The new boiler which saves 25 per cent of fuel

The advantages of this system are that not only is a much larger percentage of the heat energy of the fuel turned into useful work, but the super-heating and re-heating enable the well-known economies of compounding to be realized to the fullest extent. As a consequence the coal consumption per ton-mile has been reduced by approximately fifty per cent, ten per cent of which is estimated to be due to superheating and reheating, fifteen per cent to feed water heating, and twenty-five per cent to compounding. These figures are at present merely an estimate; but we see no reason why, with proper firing and intelligent handling of the throttle, these great economies should not be realized in actual service. The Santa Fe passenger locomotive embodies the first attempt to apply the articulated system to passenger service. The proportions are enormous, far exceeding any existing passenger locomotive either here or abroad. As far as cylinder and driving wheel arrangements are concerned, the engine is practically a combination of the

(*Continued on page 113.*)



Weight of engine and tender, 350 tons. **Tractive force,** 54 tons. **Heating surface,** 6,621 square feet. **Steam pressure,** 220 pounds. **Superheating and reheating surface,** 1,745 square feet. **Cylinders:** Two high-pressure, 26 inches by 34 inches; two low-pressure, 28 inches by 34 inches. This locomotive embodies superheating, reheating, feed-water heating, and compounding.

The most powerful locomotive. Weight, 350 tons.

A NEW ERA OF THE AMERICAN LOCOMOTIVE.

PUTTING OLD NEPTUNE TO WORK

Twice each day millions of tons of shipping in New York Harbor are lifted to a height of over four feet and dropped the same distance by the tide. This same work is done in every port to a greater or less degree. Many a man has enviously considered this enormous expenditure of power and racked his brains for a means of putting it to valuable service. However, the work done by the tides is enormous only because of its vast extent, and herein lies the delusion which many an inventor has failed to discover until he has devoted much thought and time on evolving a tide motor. The work done in raising of the "Lusitania," for instance, which weighs 40,000 tons, represents an expenditure of energy of only sixteen horse-power, this being due to the fact that the tide acts very slowly, taking six hours to raise the vessel to a height of four feet.

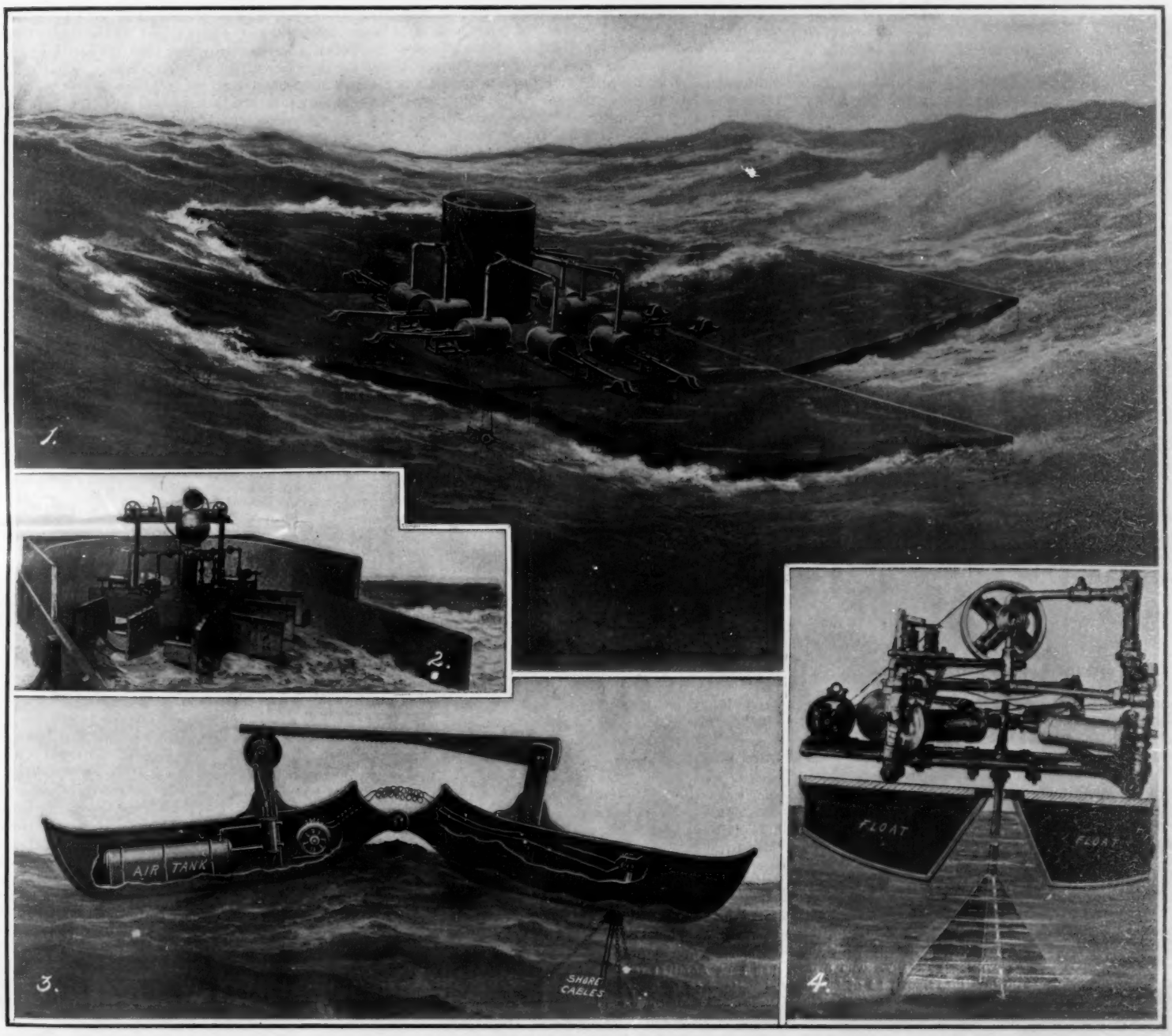
However, there is another form of energy displayed by the ocean which is far more powerful than that of the tide, and here there appears to be more opportunity for capturing a portion of this power and devoting it to practical use. The waves of the ocean are not so deliberate as the tides and the chief difficulty with which the inventor must contend is that in time of storm they develop entirely too much energy and are apt to wreck his machine.

In the accompanying engraving we illustrate some recent constructions which have been devised for the purpose of obtaining power from the waves. That shown in Fig. 1 consists of a large square float on which the principal mechanism is mounted. Hinged to this float are four auxiliary floats and the rocking motion between the auxiliaries and the main float that is utilized to operate a series of pistons pumping air into a compressed air tank. The compressed air tank and four pairs of cylinders are mounted on the main float. The piston rods are connected at their outer ends to the four floats and when these floats are rocked by the waves they serve to reciprocate the pistons and pump the air. This action takes place regardless of the direction in which the waves are traveling because the auxilliary floats extend in four directions.

An entirely different method of utilizing the force of the waves is shown in Fig. 2. This consists of a large crib placed in the water and having one end open so that the waves will wash up over the floor of the crib as they do on an ocean beach. At the back of the crib are a pair of curved deflecting walls, before which is placed a triangular casing provided with a series of swinging doors or vanes. When the waves wash up the floor of the crib they close the vanes against the casing and divided by the prow of the casing are directed against the deflecting walls. The rear of the triangular casing is opened, permitting the water to flow through as the wave recedes and strike against the rear faces of the vanes opening them to the position shown in the illustration. The vanes are geared to a series of piston rods which operate the cylinders to fill a compressed-air chamber. The latter, by means of a pair of air motors, operates a dynamo and generates electricity which may be conveyed to any desired spot and utilized.

Fig. 3 shows a construction similar to Fig. 1, making use of the rocking of two floats. The floats are hinged to each other and one carries a rack adapted to engage a pinion mounted on the other float. As the floats rock to and fro the pinion is rotated first in one direction and then the other, and this motion serves to pump air into a tank. The air from the tank operates a pneumatic motor which in turn drives a dynamo and generates electricity. In order to permit the floats to swing about in any direction without danger of fouling the anchor lines one of the floats is mounted on a swivel which is securely anchored. By means of contact wheels engaging contact rings on the swivel the electricity generated is conveyed to a pair of cables which extend to the shore.

The construction shown in Fig. 4 depends for its operation on an entirely different principle. It is well known that the wave disturbance of the ocean does not extend to any great depth, and it is the relative motion of the surface water with respect to the water at a considerable depth that is made use of in this case to generate power. A float is provided from the center of which projects a shaft fitted at its lower end with a set of radial fins. When the float is rocked by the waves the shaft tends to remain vertical owing to these fins. Mounted on the float are a series of cylinders provided with the usual pistons which are connected to an extension of the vertical shaft just referred to, and while the pistons remain virtually fixed the cylinders are reciprocated upon them by the rocking of the float. The pistons serve to circulate oil through a rotary engine which in turn drives a dynamo and thus generates electricity. When the wave motion becomes too violent an electrically-operated by-pass permits a portion of the oil to circulate without passing through the motor and thus an excessive speed is prevented.



Four novel methods of utilizing the power of the waves,

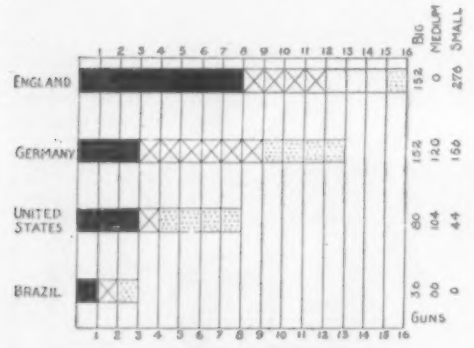
PUTTING OLD NEPTUNE TO WORK.

FOREIGN NAVAL PROGRESS IN 1909.

BY PERCIVAL A. HISLAM.

During the year just closed considerable naval activity has been manifested abroad. Not only have the principal naval powers adopted large programmes of new construction and made good progress with those already in existence, but the minor powers have shown in a practical manner how widespread a hold the Dreadnought fever has taken on the mind of the world.

Great Britain during 1909 has finished the last of the trio of battleship-cruisers of the "Invincible" type, of the details of which readers of the SCIENTIFIC AMERICAN are already fully aware, through the appearance of the "Inflexible" at the Hudson-Fulton celebrations. The three battleships of the 1906-7 programme —the "Bellerophon," "Temeraire," and "Superb"—have all been passed into service. They are of 18,600 tons, 700 more than the "Dreadnought," but differ only in having sixteen 4-inch 31-pounders for their anti-torpedo armament as compared with twenty-four 12-pounders. The end of the year saw also the completion of the battleship "Vanguard," of the 1907-8 programme, which was turned out by Vickers, Sons & Maxim in the record time for any ship since the "Dreadnought" herself, of 19 months. The "St. Vincent" and "Collingwood," completing the 1907-8 trio, will be commissioned this spring. All are of 19,250 tons, and have ten 12-inch 50-caliber guns (the main armament of the others is 45 calibers) and twenty 4-inch rapid-fire weapons. The thickness of the main belt is reduced to 9¾ inches in these ships compared with 11 inches in the earlier vessels, but a larger area of the hull is protected by thick armor. Other vessels passed into service during the year include the unarmored cruiser "Boadicea," of 3,300 tons and 25 knots, designed to act as "mother ship" to the destroyer flotillas; a number of 33-knot destroyers—"Afridi" (which had to be accepted at 32.75 knots), "Crusader," "Amazon," "Saracen," "Maori," "Viking," and "Zulu." A new type of submarine has been completed. This is the "D1," of 600 tons, which showed



FOREIGN NAVAL PROGRESS IN 1909.

unusual speed submerged. She is fitted with twin-screws, and has a steaming radius of 4,000 miles.

The vessels launched during the year are the battleship "Neptune," of 20,250 tons, with the same armament as the earlier Dreadnoughts, but so arranged that there is a broadside of the whole ten heavy guns; and the armored cruiser "Indefatigable," 19,000 tons, carrying the same battery as the "Invincibles," but longer, enabling a wider arc on either beam to be covered by the whole eight 12-inch guns. A number of small cruisers and destroyers have also been launched.

Three new battleships have been commenced. They are the "Hercules," "Colossus," and "Orion," of the same displacement as the "Neptune," but with the five 12-inch gun turrets arranged axially. The armored cruiser "Lion," also laid down, will be of 26,000 tons and 28 to 29 knots, and will carry ten 12-inch guns.

Germany has had a record year in naval construction. She has completed her first two Dreadnoughts, the "Nassau" and "Westfalen," of 18,500 tons and armed with twelve 11-inch and twelve 5.9-inch guns. Both ships exceeded 20.5 knots on trial, although designed for 19.5. The armored cruiser "Blucher" has been commissioned as flagship of the High Sea Fleet's cruiser squadron. This vessel cannot rank with the British "Invincibles," but she is nevertheless a powerful ship, displacing 15,500 tons and steaming 24.5 knots on trial. Her armament consists of twelve 8.2-inch and eight 5.9-inch guns, and her main belt is 8 inches thick. The battleship "Rheinland," sister to the "Nassau," is now running her trials, and the "Posen" will follow this spring.

Five large battleships have taken the water during the year. Three of these are battleships—the "Ostfriesland," "Thuringen," and "Helgoland," each of 20,000 tons. They are the first German ships to be armed with 12-inch guns, Krupp's having built a 50-caliber weapon firing a 981-pound shell. Twelve of these guns will be carried, as well as a similar number of 6.7-inch. In armament at least, therefore, these ships will be greatly superior to any British ship yet launched. The armored cruiser "Von der Tann" has also been launched. She is of 18,700 tons and will steam 25 knots, her armament comprising ten 11-inch and a secondary battery, it is believed, of 5.9-inch guns. The cruiser "G," following toward the close of the year, is a sister ship.

Two small cruisers, the "Kolberg" and "Mainz," have been completed. They are of 3,800 tons, carry fourteen 4.1-inch guns, and steamed 27 to 28 knots on trial. The completion of destroyers continues a factor of naval strength in which Germany leads the world. Her twelve vessels of the 1908 programme are in commission at a time when those of the British programme for the same year are only being launched.

Three battleships have been laid down, similar to the "Helgoland," but equipped with turbines. They are the "Ersatz Frithjof," "Ersatz Hildebrand," and "Ersatz Heimdall." The armored cruiser "H," of the 1909 programme, was laid down in December, 1908, in advance of the orthodox date. Two more small cruisers, twelve destroyers and some submarines have also been laid down.

All the French battleships of the "Danton" class have now been launched. They are of 18,400 tons and will carry four 12-inch and twelve 9.4-inch guns. Admiral Boue de LaPeyrere, the new Minister of Marine, has done much for the benefit of the naval service. The next ships to be laid down, two of which will be started at once, will be of 23,400 tons and will carry twelve 12-inch and eighteen 5.5-inch guns.

A start has been made in the re-creation of the Russian navy, and four battleships were laid down at the Baltic yards on June 16th last, where they will be built under the supervision of the British firm of John Brown & Co. Their names are "Gangut," "Petropavlovsk," "Sevastopol," and "Poltava," and on a displacement of 23,000 tons they will carry twelve 12-inch and sixteen 4.7. The designed speed is 23 knots. The two Black Sea battleships "Andrei Pervosvanni" and "Imperator Pavel I" have been completed, as well as the small armored cruiser "Pallada," 7,900 tons. The former are 17,250-ton vessels, carrying four 12-inch, twelve 8-inch and twenty 4.7-inch guns.

The progress of Japan is difficult to follow, owing to the contradictory reports that emanate from that country. However, two battleships have been laid down—the "Kawachi" and "Settsu," of 20,800 tons, armed with twelve 12-inch, ten 6-inch and twelve 4.7-inch guns. The "Satsuma," laid down in 1905, has been passed into service. Displacing 19,250 tons, she carries four 12-inch, twelve 10-inch and twelve 6-inch guns. Much difficulty is found in turning out ordnance fast enough to supply new ships, and the armored cruisers "Ibuki" and "Kurama," laid down in 1905, are still delayed by this cause. Two new cruisers, the "Huki" and "B" have been laid down. On 18,650 tons they will carry six 12-inch and fourteen 6-inch guns, and steam 25 knots.

Among the lesser powers Italy has laid down four large ships. The "Dante Alighieri" and "Cavour" (late "Leonardo da Vinci") will carry twelve 12-inch, and the "Michael Angelo" and "Galileo-Galilei," it is reported, eight 14-inch. Austria has launched three battleships and proposes to build four 19,000-ton vessels as soon as financial difficulties have been overcome. The first of the three Spanish ships, the "Espana," has been commenced, and will carry eight 12-inch guns on such a low displacement as 14,760 tons. The Brazilian "Minas Geraes," with twelve 12-inch, has been completed; the "Sao Paolo" is nearly ready for trials, and the "Rio de Janeiro" has recently been laid down. The Argentine is going to have two battleships built, and Chile one. A Chinese naval commission is touring Europe with the ultimate object of placing orders for three 15,000-ton ships; Turkey has sent Admiral Gamble back to England with instructions as to the ordering of two battleships; and Greece has allotted five million dollars for the purchase of an armored ship from an Italian firm.

HOW AN AMATEUR MAY FIND HALLEY'S COMET.

BY REV. RUEL W. ROBERTS.

Thinking it a laudable ambition to be the first amateur to find Halley's comet, I have been working with my 3½-inch telescope for several weeks trying to locate it. I have not learned as yet that I am the first, but being confident that I have succeeded in finding it, I have thought that other amateurs might like to know how it might be done. Since the easy method here described may also be employed by amateurs in other simple studies of the heavens, I have gone somewhat into details. Despite the fact that some astronomical journals have said that it would be some time before the comet in question could be seen in a small telescope, I have the word of a prominent astronomer that it can now be seen in even a 3-inch—provided, of course, one knows where to direct his telescope.

So the first problem is to ascertain the position of the comet. There are very few amateurs who have telescopes mounted with circles. Hence we must adopt a plan that will enable us to find it without such aids. Of course it would be an easy task to locate it if one had all the equipment of an observatory, merely by setting the telescope in the proper right ascension and declination.

Now if we will turn to the recent files of the SCIENTIFIC AMERICAN, we may find the right ascension and declination given for every other day during January and February. The data for the intermediate days can be easily deduced by taking half the difference of any two alternate days and adding it to the reading of the previous day. Next we need a good star atlas. Upton's is the one recommended in Young's Astronomy, and is the best for the average student. Such a star atlas should be one of the first books owned by an amateur. Almost any good library can furnish you with such an atlas if one is not already at hand. Then with the ephemeris before you follow the course of the comet from day to day by tracing the right ascension and declination on the map. Note the day when the readings first come near to some prominent star. This will be the time to put the method to trial. In order to know exactly how near the comet will be to the star, consult the Nautical Almanac or any other source accessible to find the R. A. and Dec. of the star. Upton or other star atlases will give the data for some of the stars.

By this process I found that on the evening of November 30th the comet was to be near Aldebaran in Taurus, so I began in good season to make my trial. The evening before I made four carefully constructed charts of the stars visible in my field of view. I used my 45-power eyepiece, and this meant about 40 minutes or 42 minutes of arc, in the field. Upton on page 14 gives the R. A. of Aldebaran as 4 hr. 30 min., and the Dec. as + 16 degrees 19 min. The R. A. of the comet on this day was 4 hrs. 30 min., and the Dec. + 15 degrees 56 min. The R. A. is the same, and the Dec. places it 23 min. south of Aldebaran. This would bring it within the field of view of the telescope. One can estimate quite accurately the number of minutes of arc within the field of view of the telescope by sighting it upon some object whose size is known. The moon is suitable for the smaller powers. It is 32

6 P. M. central standard time. Jan. 14th, 1910. **11 P. M. central standard time. Jan. 14th, 1910.**

A is a small double star; B is a star of the 8th magnitude; C is a very dim star; the collection of dots is Halley's comet.

min. of arc in diameter. Epsilon Lyraeæ may be used for the higher powers. The two principal stars of this double (in reality a quadruple star) are 3 min. apart. My 200-power presents a field of vision of about 6 or 7 min. Now if the polar axis of the telescope is pointed exactly to Polaris, it would be necessary only to make one map of the desired area and estimate the 23 min. distance to the south. I had my telescope, on this particular evening, directed from a second-story window and was not sure of my exact polar location, so I drew the four maps, hoping to be more certain of including the comet within the list. In making such observations and trying for a definite location north or south, east or west, one must bear in mind the fact that an astronomical telescope inverts the object. A little study with the moon, which can also be observed with the naked eye, will help to straighten out this matter. Now after making these four maps on the evening of the 29th, I planned to observe carefully the next evening to see if I had any object in view not viewed the night before. But the evening of the 29th was dimly illuminated by the coming rising of the moon, while the second evening was much darker, and I found many new stars in view. While I had thus planned to locate the comet by a process of addition (and this would have been the more desirable as it would have enabled a more careful scrutiny) I decided to look for it the next evening by a process of elimination. So on the evening of the 30th I carefully made four new maps of the same areas like those shown in the engraving and made about two weeks ago. Something like sixty or seventy stars appear in the cuts. After several evenings one star on the maps failed to appear again. I indicated this position by a small circle. So I concluded that this was the comet. I have since verified it by a sketch furnished me by a prominent astronomer. As it appeared in my telescope it had no such comet characteristics as a tail to enable one to readily recognize

(*Continued on page 113.*)

THE LAKE WASHINGTON CANAL.

A public work of much importance, though not widely known, is the proposed canal connecting the tidal waters of Puget Sound with the fresh water lakes, Union and Washington, lying in or adjacent to the city of Seattle, Wash. The project is a very old one, though it has yet progressed no further than the acquirement of right-of-way, the formal adoption of a project by the War Department and its submission to Congress, and certain local measures now in progress for the raising of funds to aid the government in the work.

The canal is to be a joint enterprise, to the cost of which the government and the local community will ultimately contribute about equal shares. The local community has already acquired and delivered to the United States the right-of-way, costing about $250,000. It will excavate the channel at a cost of about $1,000,000. The railroads, street car companies and city will have to construct bridges and other crossings at their own expense, so that the entire local outlay will probably foot up about $2,500,000. The government will build the lock and controlling works and a power plant. It will also build the entrance works and take care of certain other features of the project and will maintain and operate free of toll the completed work. The cost to the government will be about $2,500,000.

Following are some of the benefits of this work which justify its construction and which also justify a division of the burden between the government and the local community.

It will be of great value to the navy by giving an admirable fresh water waiting basin for vessels laid up in ordinary time of peace. Puget Sound will always be an important naval rendezvous, and the Navy Yard is only 18 miles from the canal entrance.

It will give a much-needed expansion to the harbor facilities of Elliot Bay. The practically available frontage on the Bay does not exceed 5 miles, and a large part of this is in the hands of the railroads. The opening of the lakes will give fully ten times greater frontage than at present, and much of it better situated for public convenience. It will make accessible extensive sites suitable for manufacturing establishments. The areas at present available, where both rail and shipping facilities can be had, are extremely limited.

The completion of the canal will give much-needed anchorage grounds for shipping. Many vessels are laid up during the winter, and owing to the excessive depth of water in Puget Sound, suitable anchorages are very scarce. Not only will the lakes afford better anchorage grounds, but they are free from the destructive effects of marine life which is very active in the waters of the sound. The hulls of vessels will suffer much less deterioration than in salt water. Likewise subaqueous timber construction, which cannot be depended upon for more than a year in the sound, unless the timber is "treated," is practically imperishable in fresh water. The shallower depths also will be much less expensive for wharf construction and maintenance.

The lakes are, of course, entirely free from tidal fluctuation, which on the sound has a mean range of 10 feet and an extreme range of 18 feet. The fixed level will be a great gain in all shipping operations.

The foregoing advantages are of a general character, but there are others of a purely local character that are very important.

The cost of drayage in Seattle is large because of the extremely uneven topography of the city and the absence of good grades leading up from the present water front. The canal will flank the hills, distribute freight throughout the city and reduce the cost of drayage, it is estimated, by 25 to 50 cents a ton. This saving will in a few years equal the local contribution to the cost of the canal.

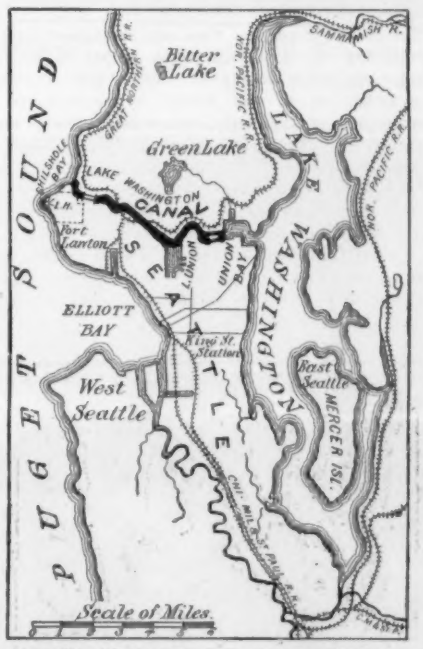
The lowering of Lake Washington to the level of Lake Union will drain all swamp areas around the shores of the lake, relieve the valley of Black and Duwamish rivers of the floods of Cedar River by turning the latter stream directly into the lake, and will make the whole run-off from the Lake Washington and Cedar River watersheds (580 square miles) available for power at the lock site. Drainage, flood protection, and accessibility to shipping will greatly enhance land values around the lakes. Lake Union will become virtually a great dock in the very heart of the city.

The removal of the natural barrier between the two lakes and the establishment of a connection with the sound will greatly enlarge the field of pleasure boating which already plays a large part in the life of the local community. Some fear is felt that the proposed changes will detract from the natural beauty of Lake Washington, but a careful analysis of the question shows that the effect will be imperceptible after a period of two or three years, and will result in improvement, so far as there will be any noticeable change.

The right-of-way for the canal is 300 feet wide. There will be a single lock with a large and small chamber. The large lock or chamber will be about 800 feet long by 80 feet wide and 36 feet deep and will take any vessel likely to visit Puget Sound for many years to come. The little lock will be 150 feet long by 30 feet wide and 16 feet deep, and will be used by small craft of all descriptions, the number of which is very large and rapidly increasing. Probably 90 per cent of transfers of vessels will be through this lock.

The entire structure will rest on an excellent foundation of very hard, tenacious blue clay of great depth. It will be built of reinforced concrete and steel and will embody the best features of modern lock construction. The controlling works at the lock will consist of a power house by which the entire flow through the canal will be turned to use. The great reservoir formed by the lake gives complete control of the run-off and distributes the flow quite evenly throughout the year. The revenue from this power will return about 14 per cent on the cost of the plant and will nearly pay for the future operation and maintenance of the canal. The problem of maintenance will be greatly simplified by the entire absence of sediment in the water and consequently of deposits in the canal and the necessity for dredging. The physical problems involved in the building of the canal are of the simplest character.

This canal has been the dream of Seattle ever since it began its existence, but the rapid growth of the city and the great variety of interests affected create opposition here and there which has succeeded in delaying the work much longer than should have been the case. It is now expected that the project will be completed within the next three or four years.



This great salt water lake will form an excellent harbor for laying up naval vessels and will increase harbor frontage of Seattle.

THE LAKE WASHINGTON CANAL.

The Boy's Endorsement.

Standing fifth among books most in demand during the week ending January 18, 1910, as reported by the Circulation Department of the New York Public Libraries, is "The Scientific American Boy," by A. Russell Bond. This endorsement from the boys themselves counts for more than the many favorable reviews that this book has received. Boys are not influenced by the criticisms that appear in magazines, nor to a great extent by advertisements. The fact that they frequently call for a book at the library is evidence that they thoroughly appreciate that particular work. "The Scientific American Boy" takes up the story of a group of boys who built tree huts, log cabins, caves, bridges, water wheels, tents, tramping outfits, etc. A sequel to this book has just been published, entitled "The Scientific American Boy at School," which continues the story and tells how to make a variety of things, including dams, boats, gliding machines, sun dials, canoes, and many new devices for outdoor recreation.

The Current Supplement.

Some Curtis turbine driven units of 14,000 kilowatts capacity are in course of construction at Schenectady. What 14,000 kilowatts means is shown in the Current Supplement by illustrating the amount of condensed water required, coal consumed, etc. The subject of marine propulsion by electric motors is presented. Lucien Fournier describes an automatic machine for registering letters. A method is described for the handling, transporting and evaporating of liquid hydrogen for the inflation of balloons. Mr. Albert Moyer, the well-known authority on concrete, presents a paper on the possibilities of the uses of mineral oils mixed with concrete. The treatment of disease by injecting into the blood the serum, or watery part, of the blood of an animal that has been made immune to that disease is popularly discussed by Dr. Fritz Meyer. Dr. V. Grafe contributes an excellent article on the miniature art of Nature and Science. Suggestions are made for observing Halley's comet. Dr. H. A. Gins writes on the optical method of studying immunity to bacterial disease. Many of our readers have no doubt wondered how an explorer can really prove that he reached the Pole, in view of the recent Copenhagen decision. The method of examining an explorer's notes and ascertaining whether or not he reached the Pole is excellently presented by Professor J. Hammon Smith.

Correspondence.

WHY BAND SAWS BREAK.

To the Editor of the SCIENTIFIC AMERICAN:

Mr. H. Miner of Lumberton, Miss., has inserted an article in your valuable paper, the SCIENTIFIC AMERICAN of November 13th, 1909, concerning the causes of breaking of springs. He also relates the breaking of bandsaws, which is a very important point to overcome, as it is a well-known fact to all who use bandsaws that a saw after running a few hours becomes longer in the back edge on account of the back pressure from the saw guide, which gradually brings the tension more and more toward the teeth or sawing edge.

If any little cracks exist by reason of improper finishing, they will certainly increase and the flaw will break. If the manufacturers of bandsaws would study this matter they would soon find out that the fault lies in the careless way of making the steel and preparing it for a saw.

Manufacturers who have won reputations for making bandsaws in smaller sizes, as from ⅛ inch to ½ inch, are looking for too great a profit and forget to make use of the same skill exerted in making bandsaws for exhibition.

By an average approximate estimate a ⅜-inch bandsaw will not run long enough to wear for one-half dozen filings before it is broken in so many places that it is impossible to make any more use of it.

Chicago. H. JOHANSEN.

A CURIOUS PHENOMENON.

To the Editor of the SCIENTIFIC AMERICAN:

While driving along the shore of Canandaigua Lake, in the State of New York, on Tuesday, January 4th, I observed a curious natural phenomenon.

The temperature of the air was six degrees above zero, a light northwest wind blowing and the bright sun of the afternoon occasionally obscured by the presence of large and low-hanging cumulus clouds.

The surface of the lake was covered by vapor caused by the difference in temperature between the cold air and the comparatively warm water. This vapor, visible in the form of a slowly rising, dense, white mist, gathered in spots in masses rising higher than the surrounding mist. As these masses of vapor reached a height of some twenty feet they appeared to take on a rotary motion and formed themselves into columns slowly rising until their apexes met the low-lying clouds, where they spread out in a funnel shape exactly as do water spouts. The columns varied from a foot to possibly ten feet in diameter; some of them ascending in a straight line and others bent into fantastic curves by the action of the wind. I saw a great number of these mist whirls during a drive of some two hours, covering a distance of ten miles along the lake shore, and as they formed and drifted slowly across the water, illuminated by the rays of the setting sun, they were a beautiful and to me a unique spectacle.

Can you tell me if similar phenomena are often observed?

Boston. JAMES S. LEE.

Speaking before the Royal Society in London on the subject of magnetic storms, Mr. E. W. Maunder, superintendent of the Solar Department of the Royal Observatory, Greenwich, said that magnetic disturbances were in some way connected with the rotation of the sun upon its axis. It was clear that, besides sending us light and heat, the sun sent some kind of influence which came only from certain portions of the surface and came along closely restricted lines. They found there was a tendency for magnetic disturbances to take place when a sun spot had got to a definite portion on the sun's disk. If they took it that the influence that came from the sun and struck the earth came from the center of the sun spot, they would be able to calculate how long it had taken place, and, assuming that, they found it would take about twenty-six hours to come from the sun, a distance of 93,000,000 miles, to the earth.

A GREAT OPEN-AIR TELESCOPE

BY PROF. S. A. MITCHELL
COLUMBIA UNIVERSITY

A giant telescope has been erected in Germany, having for its main purpose the making of astronomy popular through exhibitions to the public of the heavenly bodies. The United States has repeatedly followed Germany in her advances along scientific lines, and here would be a splendid opportunity to emulate her by the erection of a great public telescope (say) in New York city.

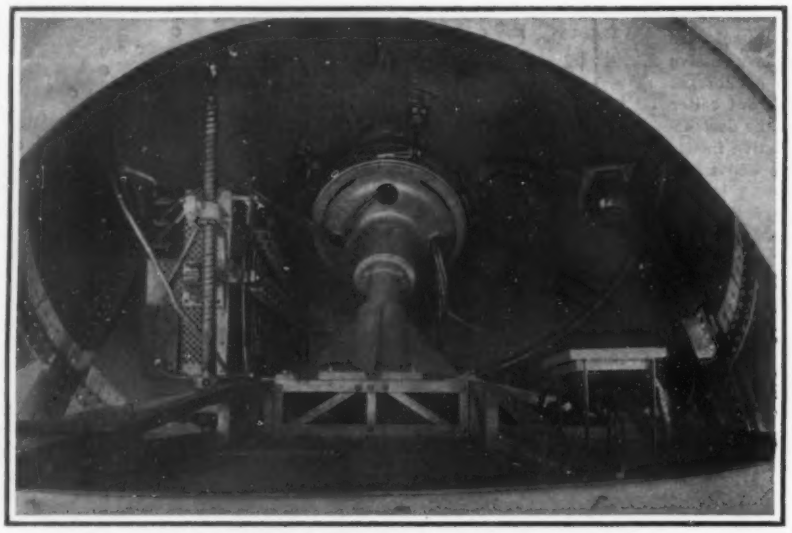
A contrast of this new German telescope at Treptow (near Berlin) with the highest development of American manufacture proves of the greatest interest. In the Yerkes telescope (see SCIENTIFIC AMERICAN, December 25th, 1909) we have a great instrument given over to exact research, handled by a corps of expert astronomers, leaders in their special lines of work. Prof. E. E. Barnard is there with his keen eye for the measurement of the positions of comets, star clusters, etc., for the depicting of slight planetary details, or with the help of the photographic plate for the portrayal of Mars on a large scale. The greatest living authority on double stars, Prof. S. W. Burnham, spends two nights each week with the great 40-inch refractor. The director, Prof. E. B. Frost, takes care of the spectroscopic side of astronomy by photographing the spectra of stars for the determining of their motions in the line of sight, and by day time the telescope is made use of to learn of interesting phenomena about the sun. This great telescope is a model of engineering perfection with its great tube and massive parts, rising floor and rotating dome. It is mounted in what is known as the equatorial form.

But how different is the Treptow telescope! Erected with other purposes in view, it is not necessary to have expert scientists to keep the telescope employed almost every hour during the day and night; constructed under a different plan, it is unnecessary to have a great elevating floor inside of a huge rotating dome, for in fact, the dome is done away with and the telescope is used in the open air! This then brings something radically new in the old science of astronomy, something entirely different in the construction of a great telescope. And this new form of instrument has many points in its favor that make it a most interesting telescope.

The director of the Treptow Observatory, Dr. F. S. Archenhold, by his radical ideas came into opposition with the German scientists who ridiculed the idea of placing in the open air with no protection from the wind a great tube 68 9/10 feet in length, seven feet longer than the Yerkes telescope (62 feet). But undaunted, Dr. Archenhold persevered and finally succeeded in collecting sufficient funds for the erection of the largest telescope in the world. And this, too, in scientific Germany!

The front-page illustration shows the Treptow telescope. The old equatorial form of mounting was departed from, for this requires that the eye-end of the telescope be raised through a vertical distance approximately half the length of the telescope tube in viewing a star overhead and one near the horizon. This necessitated a very expensive elevating floor run by electric motors (SCIENTIFIC AMERICAN, December 25th, 1909). By swinging the telescope tube in a great fork, and employing suitable counterpoises, Dr. Archenhold was able to have the eye-piece near the center of motion, and run the telescope tube upward into the air. The details of this will be readily seen by referring to the illustration. This eliminated the rising floor and saved many thousands of dollars. The low forked mounting with its heavy movable parts placed on a solid concrete foundation insured a stable instrument, and as the whole construction had no great height, it became possible to house the telescope by turning the long telescope tube into a horizontal position and pulling over it a cheap portable house. By using the telescope in the open air it became possible to entirely eliminate the great dome, and thereby save again more thousands of dollars. The result of these plans were that Dr. Archenhold was able to build the completed instrument for the modest sum of $62,500. Of this sum $11,500 was spent for the lens, which was made of the celebrated Jena glass ground by the old-established firm of Steinhiel, in Munich. The lens is 27 inches in diameter, and is an excellent one.

The radical departure from old-established forms in eliminating the dome has many points in its favor besides the mere saving of money, and also many drawbacks. As is well known to astronomers, the temperature of the night air is continually falling (especially in the early part of the night), and it is impossible to have the air in the interior of the dome at the same temperature as the outside air. This causes the heated air to pour out through the slit of the dome, and also produces currents of air in the interior of the telescope tube itself. All of this makes "bad seeing," and a distortion of the telescopic image—the bane of the existence of the professional astronomer.



View taken under the mounting, showing the electric motors for driving the telescope.

A GREAT OPEN-AIR TELESCOPE.

Dr. Archenhold's plan of doing without a dome eliminates most of the effects of air currents, for there is no "dome effect," as astronomers call it, and the air in the telescope tube quickly takes the temperature of that outside. Here, then, is a decided advantage. But unfortunately the telescope being in the open air makes it the sport of every passing wind, and even a slight wind is apt to set up a vibration in the telescope, especially so when the tube is so long as in the Archenhold telescope, which is supported not in the middle, as in the ordinary telescope, but entirely at one end. Though the vibrations may be small and imperceptible to the eye, still when the telescope is pointed at a fixed star the immense magnifying power of the long telescope would make even the slightest tremors readily visible and would spoil the use of the instrument for accurate work. It would seem that for the important researches of the exact astronomer the open-air telescope would be a failure, but for public exhibitions only it is another story. The absence of dome and rising floor eliminates a great amount of the expense, and the modest amount of the popular subscriptions can be all put into the construction of a telescope, thus obtaining a much larger instrument. The telescope is raised and a star located by means of a 6½-horse-power electric motor. In order to keep the telescope pointed correctly at the celestial object, it is necessary to drive the telescope to make it move from east to west, otherwise owing to the earth's rotation the object would quickly move from the field of the telescope. In the Treptow telescope both observer and instrument must be moved, and the details of how this is done by a ½-horse-power motor regulated by clockwork can be seen in the smaller illustration.

The Cost of Our Navy.

IT COSTS A GOOD DEAL OF MONEY TO RUN A NAVY.

The actual expense of running the navy of the United States for the past fiscal year amounted to $43,790,000. In this sum is included everything, from the pay of enlisted men to the repairs and equippage of vessels. And the vessels include the tugs and receiving ships as well as the battleships.

The battleship "Connecticut," flagship of the Atlantic fleet, may be taken as an example of the cost of keeping a vessel of that type in service. The pay of officers and enlisted men attached to this vessel with the other expenses amounted to more than $790,000 during the fiscal year just passed. The Atlantic fleet in that period included sixteen first-class war vessels, viz., six of the "Connecticut" type, five of the "Georgia" class, and the others ranging from 13,000 tons to 11,500 tons. The average cost of keeping a vessel of the "Georgia" class in commission, not including repairs, is $677,500 a year. The classes below the "Georgia" require expenditures ranging from $532,000 to $604,000. While the figures will vary for the same vessels in different years, the cost changes vary little from year to year for the same class. $10,521,000 was the total cost for running the sixteen ships of the Atlantic fleet for the past year. There were twenty-three first-class battleships in commission last year, and the total cost of keeping them in service, exclusive of repairs, was $13,035,000, making an average cost for running them $592,084. On all these ships the repairs amounted to only $100,496.

It might seem strange, but it is a fact nevertheless, that it costs more to maintain a cruiser than it does a battleship. There were ten armored cruisers in commission last year, the total cost of running amounting to $7,150,600, or an average per ship of $715,060.

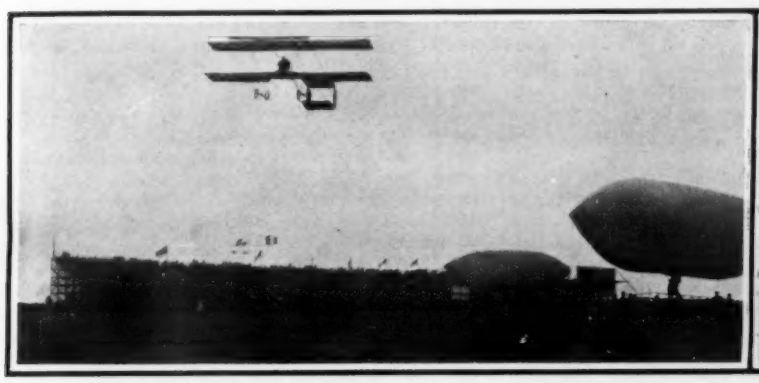
It would seem at the present time that there is to be no limit to the increased size of future battleships, and naturally there will be an increased cost of running expenses. For instance, the latest battleships to be placed in commission, the "Michigan" and the "South Carolina," each require a crew of 51 officers and 818 men. These vessels are of 16,000 tons displacement. The next that will be ready for service are the "Delaware" and "North Dakota," each of 20,000 tons displacement. Each of these fighting crafts will require 55 officers and 878 men. Then will come the "Florida" and "Utah," each of a normal displacement of 21,825 tons. These monsters of the sea will have in their respective complements 60 officers and 954 men. But we have not reached the latest vessels yet. The contracts have already been let for the "Arkansas" and "Wyoming." Remember the "Oregon" of Spanish-American war fame? Well, that is only half a battleship besides these. They displace 26,000 tons each, with a crew of 1,030 men, and 85 officers to command.

The Philadelphia Rapid Transit Company reports that on certain of its lines in that city since the introduction of "pay-as-you-enter" street cars, the number of accidents to persons has decreased 74 per cent. This remarkable change is attributed to the arrangement of closed doors and steps, making it impossible for passengers to get on or off when the cars are moving.

AMERICA'S FIRST AVIATION MEET AT LOS ANGELES

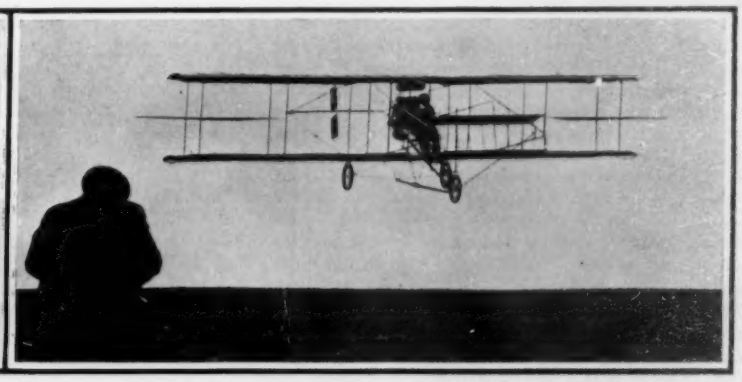
DETAILED ACCOUNT OF THE FLIGHTS MADE BY THE AMERICAN AND FRENCH AVIATORS

The first aviation meeting to be held in this country opened at Los Angeles, Cal., on the 10th instant. Louis Paulhan, the record-breaking French aviator, was present with two Farman biplanes and two Bleriot monoplanes. America was represented by Glenn Curtiss, C. F. Willard, and C. K. Hamilton, all of whom flew Curtiss biplanes. The field that served as an aerodrome was located a few miles from Los Angeles. It was not an ideal place for flying since it was not level. One end of the field was at a considerably higher elevation than the other and the machines were, therefore, obliged to fly quite high in order to pursue a level course. A hexagonal course of 1.61 miles was used. Only a few short flights were made by Messrs. Curtiss and Willard the first day. Messrs. Beachy and Knabenshue, in their dirigible balloons, flew 200 feet above the grand stand against a wind of 10 to 12 miles an hour. Paulhan made his initial flight of 8½ minutes at this time, covering an estimated distance of 3¾ miles. In the second flight he remained aloft 10 minutes. His third flight lasted 29 minutes. Be



The two Farman biplanes flying in front of the grand stand.

The Knabenshue and Beachy dirigibles are seen at the right.

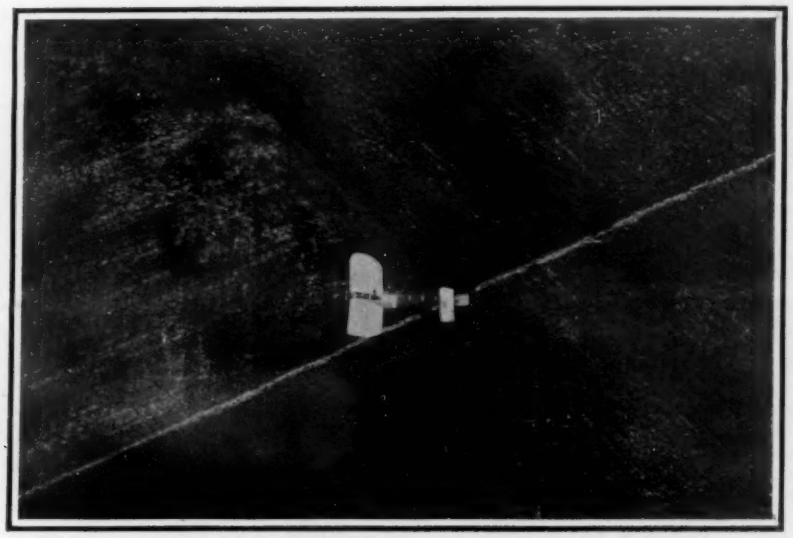


Chas. F. Willard flying in the Curtiss biplane of the Aeronautic Society.

Mr. Willard won the prize for alighting upon a square having 20-foot sides.

Mme. and Mons. Louis Paulhan.

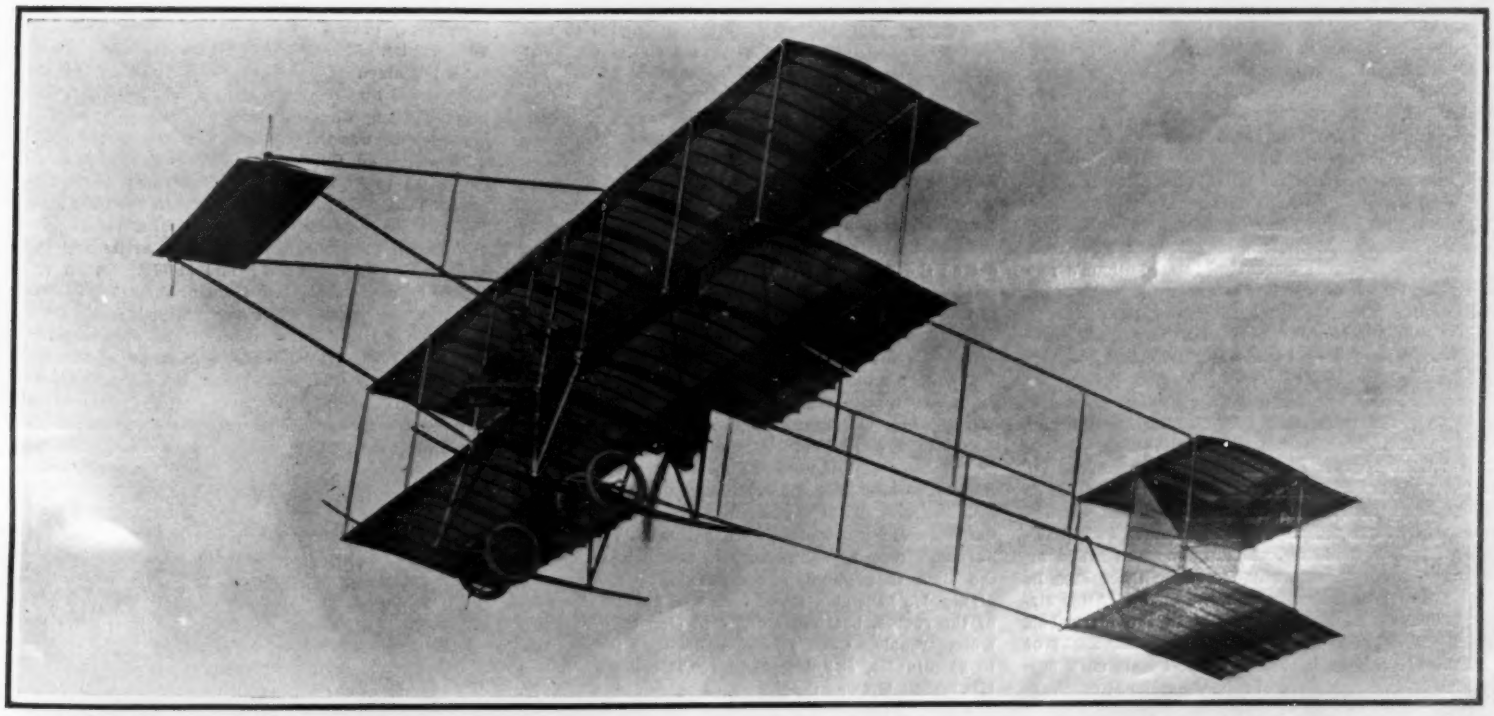
The daring French aviator and his wife hold the record for cross-country flying.



The Bleriot monoplane in flight as seen from a balloon.

These two views of the Bleriot monoplane give a good idea of its equally bird-like appearance when viewed from above or below. Paulhan flew this machine without difficulty, but his inexperienced assistants met with accidents and broke both machines.

Making a turn.



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Paulhan making his record-breaking high-flight in the Farman biplane. He reached an official height of 4,165 feet.

This machine is the most improved type of biplane produced abroad. A single vertical rudder is now fitted between the surfaces of the tail in place of the twin rudders used heretofore. The hinged wing tips for stability are set into the rear edges of the planes. Note also the combined wheels and skids for running on the ground and alighting. One blade of the propeller can be seen below the revolving-cylinder motor at the rear.

AEROPLANES AND DIRIGIBLES AT AMERICA'S FIRST AVIATION MEET AT LOS ANGELES, CAL.

sides dashing at the grand stand and just clearing the heads of the spectators, he flew out of sight over the neighboring ranches.

On the second day the first flights were made by Paulhan, who took out his new Farman biplane and drove it thrice around the course in a stiff wind, said to be of 18 miles an hour velocity, which was blowing from the sea. Next, for variety, he mounted one of the tiny Bleriot monoplanes, with which Miscarol had been attempting to get off the ground. He had no difficulty in flying it in the wind that was blowing. Although it bobbed up and down and was tossed about like a small boat on an angry sea, Paulhan flew about the field and several times swept past the grand stand, performing various maneuvers, and rising to an estimated height of 200 feet. The spectators gave a sigh of relief when he finally landed across the field from the stand. He was soon out again with his Farman biplane, in which he quickly disappeared from view far to the north. Shortly after he reappeared over the trees of a nearby ranch, and frequently charged at the grand stand, turning aside just in time to clear the spectators or else to sweep over their heads. This flight of about 8¾ miles lasted 21 minutes and 12 seconds. It was the fourth flight he had made on the second day of the meeting. After Paulhan's flights, Mr. Curtiss brought out his Rheims racer, which is fitted with an 8-cylinder water-cooled motor of 50 horse-power. Mr. Fancuilli climbed on board with Mr. Curtiss, and the machine shot into the air for its speed test with a passenger. After describing a wide circle in front of the grand stand, Curtiss flew around the course at a speed figured out by Lieut. Paul Beck, of the Army Signal Corps—one of the judges—at over forty miles an hour. Paulhan immediately started a flight. At the same time Messrs. Willard and Hamilton started on their Curtiss biplanes in front of the grand stand. Curtiss followed them a few moments after with Mr. Clifford Harmon as a passenger. All four machines were flying at the same time, a spectacle well worth seeing. Paulhan landed a few minutes later, took on one of his mechanics as a passenger, and twice circled the course as readily as he had done alone.

Curtiss established a new starting record and also a record for landing, but Willard beat Curtiss in the latter respect. Curtiss started from a marked square of 400 square feeet, flew once around the field in something over two minutes and landed exactly on the square from which he started. He broke his own record for starting by getting off the ground in 6 2/5 seconds after a run of but 98 feet. Paulhan required 12½ seconds time and a run of over 100 feet.

The great event of the third day was Paulhan's successful attempt at breaking the world's record for altitude. The existing record had been made only six days before by Hubert Latham at Mourmelon, France, with his Antoinette monoplane, and was 3,444 feet. Paulhan started in front of the grand stand, and, heading north, he went steadily upward in circles until he was nearly a mile high. So high did he fly that, to the eyes of the onlookers, the machine appeared the merest speck in the sky. After ascending some 46 minutes, he pointed his biplane once more toward the earth, and came down at a much greater angle and in about one-sixth the time (7½ minutes). The registering barometer on his machine registered 1,525 meters, or just over 5,000 feet, so that Paulhan had apparently beaten Latham's record by some 1,500 feet. He was given a great ovation upon landing. The total length of the flight was 53 minutes 46 1/5 seconds. Paulhan's height, as measured from the ground, was officially determined at 4,165 feet.

The fourth day Paulhan gave a good demonstration of the weight-carrying ability of his new Farman machine, which is much smaller and weighs 225 pounds less than the regular Farman biplanes, by taking up his two assistants, Maisson and Miscarol, and circling several times around the course with them. Curtiss circled the course ten times in 24 minutes 54 2/5 seconds. Paulhan tried to beat this time and failed by five seconds only. Previously, he made three laps in 8:16 1/5, carrying his wife as a passenger. After circling the field he alighted readily in the marked-off square from which he started. In another flight of 7 minutes' duration he carried Mrs. Ferris as a passenger. He again resorted to his sensational methods, flying low over the grand stand, making sharp turns, etc. Hamilton, Paulhan, Curtiss, and Willard qualified in three-lap flights for all events. The first named made a flight with his vertical rudder locked, in order to show that this rudder does not have to be used in connection with the balancing planes, as is done by the Wright brothers when they warp the planes of their machine to correct its transverse equilibrium. This combined operation of the equilibrium-maintaining device with the vertical rudder is one of the strongest claims in the Wright patent. Where plane warping is employed, it is necessary, in order to prevent the slewing around of the machine, when the plane is warped to a greater angle. With balancing planes like those used by Curtiss, the resistance inserted at one end of the machine is as great as at the other, the consequence being that the vertical rudder does not necessarily have to be used. This flight with the rudder fastened demonstrated very well the difference between the two systems. Mr. Willard again flew once around the course and landed in a measured square, thereby winning a prize of $250. Paulhan was presented with a $500 silver cup by enthusiastic citizens of San Diego. The next day he made a cross-country flight of some 16 miles to San Pedro and back, circling above the revenue cutters in the harbor and being greeted with cheers by the inhabitants. Paulhan also made 6 circuits of the course with his assistant in 18½ minutes, and afterward flew twice around it alone in the Bleriot monoplane. His fastest lap in the latter machine was done in 2:48, which equals a speed of 34.14 miles an hour. Curtiss made the fastest lap of the course in 2:12—a speed of 43.45 miles per hour. Subsequent to a race with Beachy, Knabenshue made a lap in his dirigible in 5:10 2/5—a rate of 18.4 miles per hour. Hamilton tried for the slow lap prize and succeeded in making one circuit of the course in 3:36 2/5—a speed of 26.78 miles an hour. The time of Willard's slowest lap was 3:11 1/5. Hamilton made a 12-minute flight for altitude, reaching a height of 530½ feet.

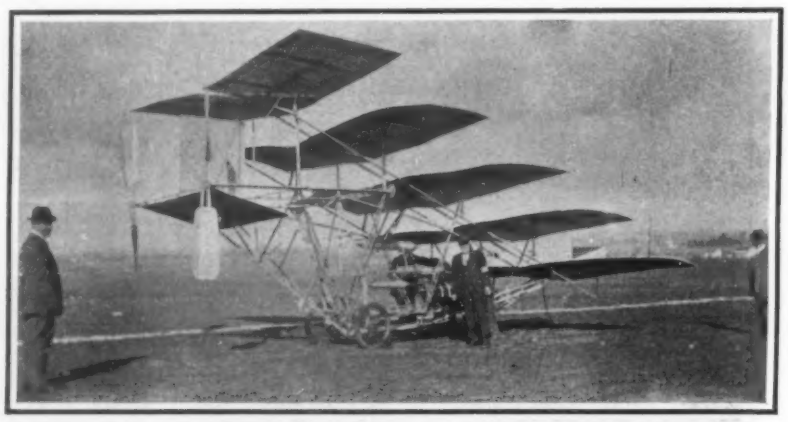
But very little flying was done on the sixth day of the meeting, owing to wind and rain. The field was wet and muddy, but notwithstanding this, all the aviators got off the ground without much difficulty and made a few short flights. Paulhan attempted to beat Curtiss' ten-lap record, but he was unsuccessful. Willard and Hamilton also made an attempt at this record, the latter covering the 16.1 miles in 30:34 3/5 or at an average speed of 31.7 miles an hour. Miscarol, Paulhan's assistant, made a brief exhibition flight with a Bleriot monoplane. In landing, the machine tipped to one side, causing the wing to strike the ground and break off. The accident was blamed upon the substitution for wing warping of the movable ends of the tail, which normally move together and act as the horizontal rudder. By moving these ends of the tail in opposite directions, the transverse equilibrium can be maintained fairly well under ordinary conditions, although this method is not so positive as that of warping the wings themselves.

Sunday, January 16th, but few flights were made, as the weather still remained inclement. The following day, however, Paulhan attempted to break Farman's record of 4 hours and 17 minutes. After remaining aloft 1 hour, 58 minutes, 27 2/5 seconds, during which time he covered 75.6 miles, Paulhan was obliged to descend on account of a leak in the gasoline tank. He therefore did not come within 2¼ hours of equaling Farman's record. Hamilton also flew during some of the time that Paulhan was making his endurance flight. He kept at a lower level and made 11 circuits of the course, but was obliged to stop on account of motor trouble. Curtiss lowered his time for ten laps to 23 minutes, 43 2/5 seconds (40.71 miles an hour). His fastest lap was three seconds slower than his best previous circuit. Paulhan covered ten laps in 25:5 1/5. Beachy made one lap in his dirigible in 4:57 4/5 (19.46 miles an hour). This was the fastest lap scored by any dirigible during the meet. The Gill-Dosch biplane, which is very much like the Curtiss, and which was constructed by two gentlemen from Baltimore, Md., made several attempts to get off the ground, but was only successful in making a few short jumps. Mr. Clifford Harmon made a short flight alone in his new Curtiss machine.

Tuesday, January 18th, is noteworthy for the long cross-country flight of Mons. Paulhan, who flew to "Lucky" Baldwin's ranch and back, a distance of about 47½ miles, in 1 hour, 2 minutes, 42 4/5 seconds. In the course of this flight he rose to a height of 2,130 feet, according to the registering barometer carried in the biplane. Most of the time he was at a height of between 1,000 and 2,000 feet. During the return journey, which was made in about 33 minutes, Paulhan had to fight against a rather strong westerly wind, and yet he is said to have required only about three minutes more returning than he consumed in flying to the ranch. Probably at the elevation at which he was traveling he did not encounter as strong a wind as was blowing near the earth.

January 19th was given up to the making of a number of flights with passengers. The weather was perfect save for a puffy wind in the early afternoon, which later died out altogether. About 2:30 P. M. Paulhan started on a cross-country flight with his wife as a passenger. After circling once around the field he left the course and headed directly toward the ocean. He flew at a height of some 500 feet to Redondo Beach. In the course of his flight he passed over several other neighboring seaside resorts. He returned safely after 33¾ minutes, having covered over 20 miles across country without difficulty. This flight was twice as long as that made by Orville Wright at Fort Meyer last summer in the speed test for the government. It is the longest cross-country flight ever made with a passenger, although it was not by any means as hazardous as the one made by Mr. Wright. Other flights were made with Mrs. C. F. Bishop, Lieut. Paul Beck, W. R. Hearst, and a reporter for a New York newspaper. For the second time Lieut. Beck tried dropping dummy bombs upon a measured square on the ground. While he did not succeed in hitting the mark, he came very close to it, and showed the possibility of dynamiting a warship or a town in this way. Paulhan's last flight was made with Mr. Harmon as a passenger. It was a cross-country flight of 8 to 10 miles lasting about 20 minutes. Hamilton made three attempts at high flying, rising to heights of 455, 300, and 700 feet, respectively. The Gill-Dosch biplane was finally made to fly and was driven once around the field by Hillary Beachy. In descending, however, it was badly damaged. Curtiss made two laps, but was unsuccessful in breaking his speed record.

The last day of the meet, January 20th, Curtiss made the longest flight he has ever accomplished. Starting at 3:25 P. M., Paulhan had made but two or three laps, when Curtiss went aloft about half a lap behind him. Mounted on his Rheims racer, Curtiss steadily gained upon Paulhan, and after making three laps passed him in front of the grand stand, his small biplane flying directly above the larger French machine. This was the first real race the spectators had witnessed, and Curtiss received great applause. He continued to fly around the course until he had covered 30 laps (48.3 miles), his time being 1:16:39. Paulhan made 35 circuits of the course (56.35 miles) in 1:34:34. The average speeds of Curtiss and Paulhan were respectively 37.8 and 35.77 miles an hour. Hamilton made a flight to Moneta, about 7 miles from the aviation field. He rose to a height of several hundred feet and disappeared from view upon the horizon. Upon his return the crankshaft of his motor broke when he was nearly back, and he succeeded in gliding down to the field and alighting without mishap. A feature of the last day was a parade showing the evolution of locomotion. The parade opened with an old-time "prairie schooner" and ended with the aeroplanes.



Prof. J. S. Zerbe's multiplane. This machine is of the following plane type.

A NOVEL AMERICAN AEROPLANE AT THE LOS ANGELES MEET.

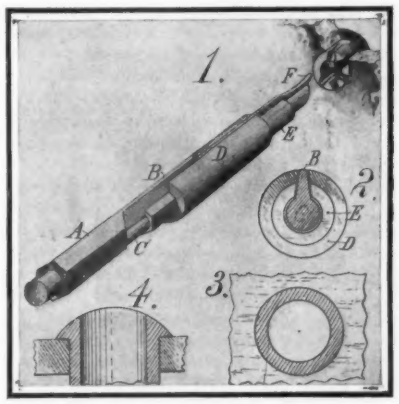
The Boston Aeronautic Show.

The first Aeronautic Show to be held in America as a separate affair will open in the Mechanics Building, Boston, Mass., the evening of February 23rd. This show will be held under the auspices of the Aero Club of New England, and a number of men well known in the aeronautical world stand sponsors for it. Besides numerous models of aeroplanes, there will be exhibited a number of full-sized representative machines. A duplicate of the United States government's only dirigible balloon will also be on view. Inventors and experimenters having anything to exhibit should communicate at once with the manager of the show, Mr. Chester C. Campbell, 5 Park Square, Boston, Mass.

Patent Department

TOOL FOR CUTTING STAY BOLTS.

Stay bolts in locomtive boilers usually break near the inner side of the outside boiler sheet. When the broken bolt is in position behind the frame of the locomotive it is necessary to drill the bolt on the firebox and drop it out of the way, after which a hole is bored



TOOL FOR CUTTING STAY BOLTS.

through the stub in the outside sheet and the part of the bolt remaining is cut out with a round-nose chisel. This is difficult to do, and it sometimes happens that the sheet is grooved in the operation, and trouble is caused thereby. With a view to overcoming this difficulty the tool illustrated in the accompanying engraving has been invented. It consists of a cutting member arranged to move in a sheath which can be fitted into the hole drilled in the bolt and serve as a guide for the cutter which is then operated to cut out the bolt. The body of the tool, which is of hexagonal form, is indicated at *A*. Projecting from the body *A* is a blade *B* formed with a bead *C* at its lower edge. The sheath above referred to is indicated at *D* and is formed with a central bore to fit the bead *C* and a slot to receive the flat portion of the blade as indicated in Fig. 2. The sheath *D* is reduced at *E* to form a centering guide. The bolt to be removed is first drilled out, as indicated in Figs. 3 and 4, to the diameter of the part *E* of the sheath. The portion *E* is then fitted into the bore, after which the cutting tool is operated to drive the end *F* of the blade into the bolt and cut it out as indicated in Fig. 1. After the bolt has been cut at three or four points it may easily be knocked out. Mr. William Smith of Peshtigo, Wis., has secured a patent on this new cutting tool.

UTILIZING CENTRIFUGAL FORCE PRACTICALLY.

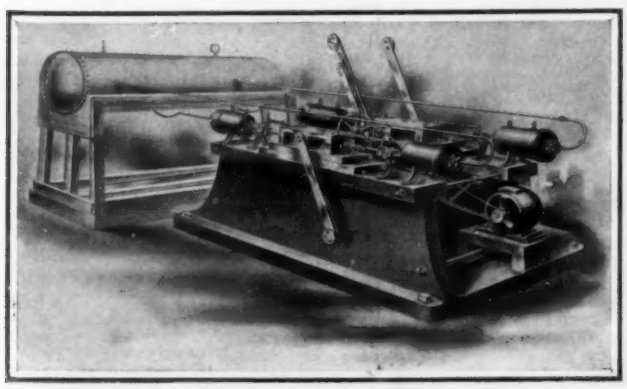
A Danish engineer, resident in New York city, Dr. Albert C. Albertson, has endeavored to turn to practical use the enormous centrifugal force generated by a rotating body. His invention is at present embodied in an actually constructed and operative air compressor, with what success we leave our readers to judge from the accompanying illustration and the following brief description:

In each of two parallel guide frames a block is mounted to reciprocate. Each block is connected with the piston rods of a duplex compressor. Through the blocks an axle runs to the end of which is attached a weight-carrying arm. When the arms are thrown forciby to one side or the other, each block moves back and forth, because the centrifugal force produced at the weighted end of the arms is endeavoring to carry the weight off at a tangent to the circle from its own center. But the center of each circle is the axle in the respective block. Hence the blocks move outward in their guide frames as the arms are thrown out. The angle bearings, center, arm weight are all therefore constantly changing position so long as the arm is being turned fast enough. Each centrifugal arm in its flight does not describe a circle, but rather an ellipsoidal curve due to the shifting of the block.

The two guide frames, as has been stated, are placed parallel to each other, each having a block, arm, weight, etc. The blocks are held in opposite positions so that the arms will balance each other and so that the two blocks will always reciprocate in opposite directions.

The means employed to hold the centrifugal arms in position, and yet allow them to follow their respective "pulls," consists of a shaft between the guide frames with two crank arms, each of which has a pin extending into a slot cut in each arm. The crank shaft is driven by a small motor. As the cranks turn, the centrifugal arms are turned by the pins which project in the arm-slots. The greater the speed of the crank, the greater the power of the centrifugal arms. Because there is no connection between the centrifugal arms and the cranks, the reciprocating action of the blocks is caused entirely by centrifugal force.

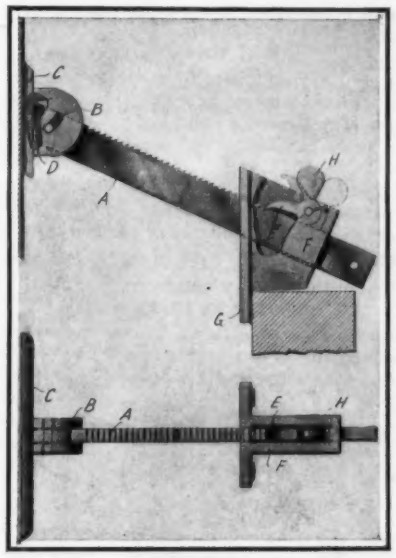
It is a curious though easily comprehensible fact the amount of centrifugal force developed was so great in the machine illustrated that it was necessary to cut away part of the material of each arm and to reduce the weight so that the pistons would not hammer against the cylinder heads.



CENTRIFUGAL MACHINE.

BRACE FOR BRICK KILNS.

During the process of baking bricks the kilns expand and contract, and if the sides are not braced after they have contracted they are apt to topple over if the kiln should expand again. Hitherto it has been the custom to brace the sides of a kiln with timbers and wedges, which work involves considerable

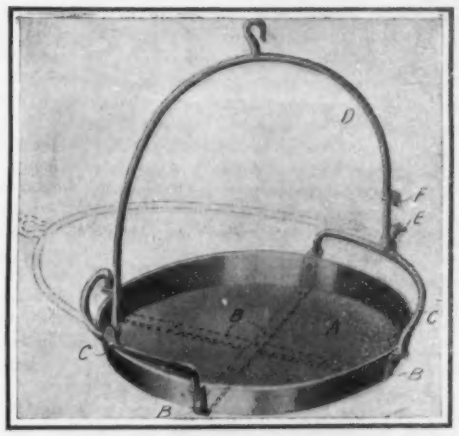


BRACE FOR BRICK KILNS.

danger to the workmen while adjusting the wedges. In order to remove this danger an inventor has recently devised the brace illustrated in the accompanying engraving. It consists of a bar *A* formed with teeth along its upper edge. One end of the bar is provided with a pair of studs adapted to engage a curved slot *B* in a supporting member *C*. The base of the supporting member is made broad so as to provide a large bearing surface. The bar *A* enters a recess in the supporting member and is cut away at *D* so that when the supporting member is pressed against the wall of the kiln the upper edge of the base will dig into the wall, as shown in one of the illustrations. The teeth on the bar *A* are adapted to be engaged by a pawl *E* which is fulcrumed in a member *F* that is supported on a timber disposed along the side of the kiln. The member *F* is held in place by teeth *G*, which dig into the wood. The pawl *E* is provided with a thumb piece *H* by which it may be lifted out of engagement with the ratchet teeth in the bar. In using this brace the workman thrusts the supporting member *C* against the side of the kiln and places the member *F* in position on the timber. Then pressing against the kiln with his foot he takes up the slack between the two members *C* and *F* by engagement of the pawl *E* with the ratchet teeth on the bar *A*. Mr. Anatole Perusse (care of J. McLean, 245 East Strand, Rondout, N. Y.) has just received a patent on this improved brace for brick kilns.

BUTCHERS' SCALE PAN.

It is customary for butchers to weigh meat in large scale pans that are usually provided with a rigid bail which is also of large dimensions, and the fact that the bail is rigidly attached to the pan makes it inconvenient to stow away the pan when it is not in use. The accompanying engraving illustrates an improved form of butcher's scale pan in which the bail is so mounted that it may be folded down against the pan when it is

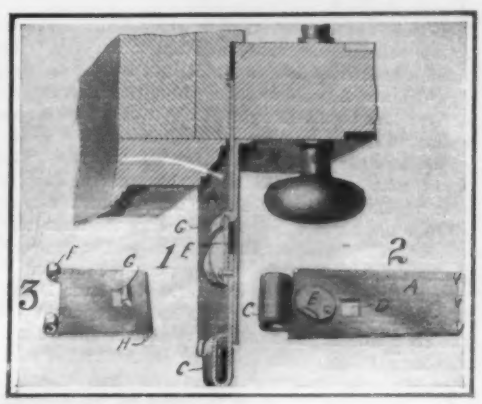


BUTCHERS' SCALE PAN WITH FOLDING BAIL.

not in use, but whenever desired may be locked rigidly in an upright position. The bail is not directly connected with the pan, but to a pair of rails which serve to distribute the strain. In our illustration we have lettered the pan proper *A*. Riveted to the pan at the bottom are a pair of diametrically disposed straps *B* which cross each other at right angles and are bent up at the ends against the sides of the pan. The two rails *C* which are curved to conform approximately to the shape of the pan are secured to the ends of the bars *B*. Hinged to these rails is the bail *B* which is provided with the usual hook for attaching it to the scales. One of the rails *C* is formed with an outwardly projecting flange *E*, in which is a square aperture adapted to receive a finger *F* that is free to slide on the bail *D*. When the finger *F* is fitted into this aperture the bail is held rigidly in upright position. On lifting up the finger *F* the bail is released and may be folded to the position indicated by dotted lines in the engraving. Mr. Jacob Feldman of 70 Carlton Avenue, Brooklyn, N. Y., has recently secured a patent on this improved scale pan.

DOOR SECURER.

A very convenient device for securely locking doors has recently been invented which should be of particular value to traveling men who often find it necessary to occupy a bedroom not fitted with an efficient lock. The locking device may readily be applied to any door without marring it in the least. As shown in our illustration, it consists of two plates. The larger plate *A* is provided with teeth which are placed against the jamb of the door and when the door is closed on the plate it forces these teeth into the wood. The opposite end of the plate *A* is turned back upon itself to form a bearing *C*, the purpose of which will presently be explained. A square opening *D* is cut through the body of the plate *A* and adjacent to this opening a cam or eccentrically mounted disk *E* is provided. The second plate, as shown in Fig. 3, is formed with bearings *F* adapted to fit at opposite sides of the bearing *C* and receive a screw that passes through the bearings of both plates, being threaded into one of the bearings *F*. The smaller plate is also provided with a lug *G* which projects through the open-

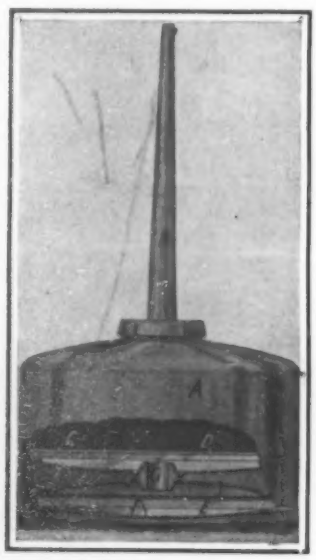


SIMPLE DEVICE FOR SECURING DOORS.

ing *D* in the plate *A*. The lug *G* is recessed to receive the cam *E*, and the latter is turned to press the step *H* against the door and thus lock it shut. In order to allow for the movement of the smaller plate as the cam *E* is turned the bearing *C* of the larger plate is elongated as shown in the drawing. The inventor of this door securer is Mr. Charles W. Lent of Tingley, Iowa.

AN OIL CAN.

The oil can illustrated in the accompanying engraving belongs to the class embodying a flexible bottom which is operable to cause a flow of oil. The construction here shown, however, is arranged to provide a considerably greater flow of oil than is obtainable in cans of the conventional construction. This result is secured by providing three diaphragms in the can, one of which serves as the bottom of the can, while the other two are connected at the center by a nipple. In this manner an oil chamber separate from the main portion of the can is formed. In the accompanying engraving the can is shown at *A* with the usual nozzle *B* threaded into the upper end. Fitted into the lower end of the can is a retaining ring *C* which has extending flanges at the upper and lower ends and is also bent outwardly at the lower end to fit against a shoulder formed in the can body. The dished diaphragms *D* and *E* bear against the flanges of the retaining ring. The two diaphragms *D* and *E* are connected at the center by the nipple *G*. The diaphragm or bottom *F* is soldered fast to the can body. An oil chamber is thus formed between diaphragms *F* and *E*. In operation when the bottom of the can is pressed inward it drives the oil from the oil chamber with greater pressure than would be the case if the entire can body formed a single oil vessel. At the same time

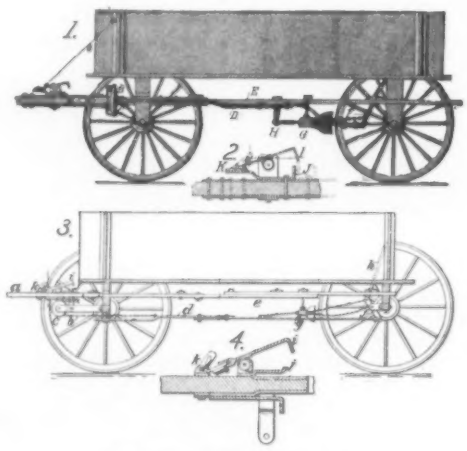


TRIPLE-BOTTOMED OIL CAN.

the other two diaphragms yield as well, thus effecting a large discharge of oil. Mr. Frederick G. Svetlik of Cadott, Wis., has recently secured a patent on this improved oil can.

AUTOMATIC WAGON BRAKE.

Two patents have recently been issued on the subject of wagon brakes, describing a form of brake for use on carriages and wagons, that will be automatically applied when the horse is checked or presses back against the load when going down hill. The brake may also be applied by hand and can be thrown out of automatic operation whenever it is desired to back the vehicle. In order to take off the strain upon the mechanism when traveling around curves or over rough roads, a flexible connection is made between the tongue and the brake mechanism. In Fig. 1 the tongue is indicated at *A*. It is provided with a crowned roller *B* mounted on a vertical axis which bears against a crown roller *C* mounted on a horizontal axis. The roller *C* is carried between two arms of a brake reach *D* which are disposed at each side of the main reach *E* and are free to slide longitudinally in the hounds. The brake reach *D* is connected at the rear end to a lever *F* which is connected by chains to the brake beam *G*. The latter carries the brake shoes that bear against the rear wheels of the vehicle. The brake beam is connected by a spring to a post *H* carried by the main reach *E*. It will be evident that when the tongue is pressed backward or when the vehicle rides forward on the tongue the brake reach will throw the lever *F* backward, drawing the brake shoes into engagement with the rear wheels. A hand lever extends upward from the lever *F* to permit of operating the brakes manually. In order to throw the automatic mechanism out of operation the tongue *A* is locked to the hounds by means of a simple mechanism. It consists of a lever *I* with a downwardly projecting flange adapted to engage a flanged piece *J* carried by the tongue. The lever *I* is mounted in brackets secured to the hounds and is normally spring-pressed out of engagement with the piece *J*. A cord running from the lever *I* to within convenient reach of the driver may be drawn upward to throw the lever *I*, whereupon a latch *K* will engage a stop piece serving to hold the lever in set position. With the crosspiece *J* set as shown in Fig. 1 it is possible to lock the brakes against the



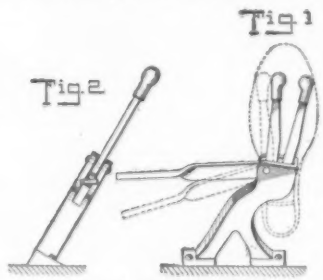
AUTOMATIC WAGON BRAKE.

wheels, while if the piece *J* is set with the flange at the opposite side, as shown in Fig. 2, it serves merely to lock the tongue to the hounds in such position that it cannot set the brakes.

The second construction referred to is similar to that shown in Fig. 1, and corresponding parts are referred to by the same, but lower-case, letters. The tongue *a* is connected to the brake reach *d* by means of a chain *b* which passes over a pulley *c*. The brake reach *d* is connected to a lever *f* which in turn is connected by means of chains to the brake beam *g*. The brake beam is connected by a link to the main reach *e*, and is held in inoperative position by a spring attached to the brake reach *d*. The hand lever for operating the brake is shown at *h*. A locking device similar to that shown in Fig. 2 is indicated in Fig. 4 comprising a lever *i* mounted on the hounds, a lug *j* mounted on the tongue and a latch *k*. The inventor of these wagon brakes is Mr. Eben G. Dolan of Starksboro, Vt.

ODDITIES IN INVENTIONS.

Improved Shoe Stretcher.—The shoe stretcher illustrated herewith is so arranged that it may be adjusted for stretching shoes of different sizes and shapes, and for applying the pressure at any point desired, so as to stretch the shoes to a comfortable fit. The stretcher is provided with a stationary base, formed with an arm at its upper end, which terminates in a knob. Fulcrumed in the base is a bell-crank lever, one arm of which is also provided with a knob, mating that of the fixed arm. By depressing the bell-crank lever, the knobs will be forced apart, stretching the shoe at the points of contact. These knobs are removable, and are provided at one side rounded and the other projecting. Each knob also has a square tapered opening adapted to fit the arms of the shoe stretcher. The knobs may readily be applied, either with the projecting portion bearing against the shoe, or with the rounded portion, as desired.



IMPROVED SHOE STRETCHER.

Rocking Attachment for Rocking Chairs.—An inventor has recently procured a patent on a device for rocking chairs, without placing the feet on the floor. The particular advantage of this scheme is that a slight movement of the feet will cause the chair to rock. Fulcrumed to the rockers are a pair of levers fitted with rollers at one end to engage the floor, at the opposite end connected by means of links to a pair of bell-crank levers forming a sort of a treadle, on which the operator's feet are supported. By pressing this treadle downward, pressure will be brought to bear on the rollers, causing the chair to rock. When desired, the mechanism may be thrown out of operation by folding the treadle up against one of the cross pieces of the chair.

ROCKING CHAIR ATTACHMENT.

Doctoring Oriental Rugs.

Of the hundreds of thousands of dollars worth of Oriental rugs brought into the United States annually, many of them are what is known to the profession as "washed rugs." This means that brightly colored Oriental rugs are sometimes washed with a solution of chloride of lime, a treatment which partly bleaches the colors and imparts a soft appearance to the rug. The chemical treatment is a process of washing which produces the effect of age and a peculiar sheen to the surface, which is pointed out by many dealers as a proof of superior quality. The fact is, however, that the process of washing invariably weakens and in some instances destroys the materials of the rug. The progressive effect of the chemical treatment of the rug is this: The chlorine gas contained in the chloride of lime attracts oxygen and moisture from the air, by which muriatic acid is formed. This eats away the vitals of the fabric. Sooner or later the wool and cotton in the rug become brittle, and thus weaken the warp and deteriorate the wool. When this deterioration is complete, the pile of the rug may be swept away by the ordinary process of sweeping, and the warp, which is the foundation of the rug, becomes so weak that holes appear here and there, and soon the rug is worthless.

It not seldom happens that a Persian rug is too glaring in some bright hue, perhaps red, and is not salable. An unscrupulous dealer will subject the rug to the series of washings in chemically prepared water. In this way he turns out a rug possessing a soft antique sheen that is truly captivating, and finds a ready purchaser for the doctored floor covering.

A New Comet Discovered in South Africa.

A new comet visible to the naked eye was discovered at Johannesburg on January 16th by Innes, in right ascension 19 hours, 50 minutes, 28 seconds and declination minus 23 degrees, 59 minutes 24 seconds.

At the time of its discovery the comet had an hourly motion in right ascension of plus 41 seconds of time and declination of plus 6 minutes 4 seconds of arc.

The comet discovered is brighter than Venus. At Lick Observatory it was easily seen with the naked eye at noon about four degrees east of the sun and one-half degree north of it, moving northeast.

For a few nights the comet was a brilliant object in the clear southwestern sky just after sunset.

Readers of the Scientific American will hardly confuse this comet with Halley's, which has been the object of constant study since September 11th, when it was sighted. The South African body is one of the two or three comets which are usually discovered every year.

Dr. Joseph E. Pogue who is in charge of the Division of Mineralogy in the U. S. National Museum, has recently described in the Smithsonian Miscellaneous Collections a remarkable specimen of pyrite studded with crystals of gold and partly covered with plates of galena from the Snettisham district near Juneau, southeast Alaska. The pyrite is in the usual form of a cube, but what is very remarkable is that there are on it more than one hundred and thirty well-defined crystals of metallic gold. These are also in the cubical system and from one-third to one-half buried in the pyrite, never more, and seem to have no definite relation to the crystallization of the pyrite. Similarly, crystals of galena and chalcopyrite are found on the pyrite. The structure and relation of the galena to the pyrite is of considerable scientific interest and is described in technical detail by the author. This very unusual occurrence of these minerals in crystallographic juxtaposition is described by Dr. Pogue as follows: "The pyrite, when its present size was nearly attained, sustained a deposition of crystallized gold upon its surface followed by the precipitation of a small amount of chalcopyrite which, in turn, was succeeded by the formation of the galena. A further slight accretion of pyrite completed the development of the specimen."

Failure of a fly-wheel, says Power and the Engineer, usually begins by the starting of a minute crack on the under surface of the rim at the point of greatest stress, viz, near the ends of the arms adjacent to the rim joint. The cracks gradually deepen until failure occurs, with all its disastrous consequences. These minute cracks are visible to an experienced eye, and careful inspection will aid materially in the prevention of fly-wheel explosions.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

STORAGE BATTERY.—P. M. MARKO, New York, N. Y. In this case the invention refers to improvements in storage batteries, and more particularly to means whereby the strength of the battery may readily be ascertained without the aid of outside instruments, attachments, or connections. The electric meter is constructed to specially adapt it to the battery and need have a range of only the capacity of the battery.

ELECTRICALLY-OPERATED HAMMER.—L. PAULERO, Petersburg, Va. The present invention relates to hammers of the type referred to in a former patent granted to Mr. Paulero. It contemplates means for maintaining various parts cooled while in action under conditions wherein such parts are usually heated. It also provides means for improving the adjustment of the stroke of the hammer.

ELECTRICAL-FUSE BLOCK.—A. A. MOFFITT and G. E. ANDREWS, Providence, R. I. In this case the invention relates to fuse blocks and fuses to be used in connection therewith, the more particular purpose being to so adjust the fuses relatively to the fuse block, as to prevent the insertion in a particular block of a fuse built for greater amperage than one intended to be inserted in said block.

KEYBOARD-OPERATING MECHANISM.—H. KNUDSEN and H. BARTA, 12 Cyril Mansions, Battersea Park, London, England. This invention relates to a system of type-setting by wireless means which can be attached to or worked in combination with linotype machines, or those of similar construction, and relates particularly to means for the operation of type-setting apparatus of the type in which parts are synchronously moved in the transmitting and receiving machines so that when a contact is made in the former a corresponding one is made in the receiving machines.

Of Interest to Farmers.

PLOW.—J. COLOMÉ, Caracas, Venezuela. The purpose of the inventor is to provide an improvement upon the old Arabian plow still widely used in the Spanish republics, whereby to render the said type of plow more efficacious without complicating its construction, and to better adapt it for use in mountainous districts.

PRUNING IMPLEMENT.—A. H. BASTIAN, Sellwood, Ore. In use, an operator takes hold of the pole with one hand and the runner sleeve with the other, which will enable him to hook the fixed blade upon a limb or branch to be removed, whereupon a downward sliding movement of the sleeve will rock a lever downward and forcibly rock a blade so that its convex cutting edge will impinge upon the limb and sever it. Means provide for restoring the blades for renewed service.

COTTON CHECKER AND CULTIVATOR.—R. HAMILTON, Gouldbusk, Texas. An object here is to provide a device by means of which the width of the hills or rows may be adjusted to suit the requirements of various grades of soil. Further, to provide means by which the plows of the cultivator may be simultaneously raised or lowered, and when so may be kept in their adjusted positions. Mr. Hamilton has invented another checker and cultivator for use in simultaneously raising and lowering a plurality of plows in a cultivator, and means for simultaneously turning a plurality of disk cutters.

JOINTER ATTACHMENT FOR PLOWS.—P. S. SIDELL, Shreve, Ohio. Means are provided for detachably connecting a single or double pointed jointer blade, directly upon the standard of the plow share and near to the mold board, forming an upward extension thereof, which will cut off vines, shear cut sod, and turn such cut material as well as loose soil into the furrow formed by the progressive movement of the board and plowshare.

COTTON-HARVESTER. — D. H. MAYS, Benoit, Miss. The harvester is adapted for gathering cotton from the maturing plants and for separating the same from foreign substances which are gathered therewith. In gathering cotton, it effects the operation without injuring the plants, and leaves them in the same condition as before the cotton is gathered.

BALING-PRESS.—J. O. EKLEBERRY, Upper Sandusky, Ohio. Among the principal objects in view are: to provide a mechanism for pressing hay or like substances by successive steps and with maximum pressure; a mechanism wherein the return of pressure mechanism to the receiving position is rapid; means whereby the material being handled by the device is fed in unison with the pressure mechanism; and means whereby the pressure mechanism is positively returned to its initial position.

Of General Interest.

MOISTENER.—J. H. BORDEAUX, Joliet, Ill. In the present patent the invention is an improvement for moisteners for labels, envelopes, stamps and other gummed surfaces, and it is designed as either a desk or pocket article, in which capacity it is intended to be both sanitary and leak-proof.

LUBRICATOR FOR CABLES. — W. F. SLAUGHTER, Republic, Mich. In the traverse of cables employed for the draft of cars and general haulage purposes in mines and other places, it frequently occurs that cables are unduly worn from frictional contact with each other if they cross, or with supporting means such as pulleys or the like. The device automatically coats a running cable with a lubricant and removes any excess, thus preventing injurious wear, or rusting of a wire cable.

HORSESHOE.—R. C. MEYERS, Trenton, N. J. The object here is to provide a shoe arranged to securely hold the calks in position without danger of the calks becoming accidentally loose while the shoe is in use, to allow of conveniently removing the calks for sharpening, the renewal or exchange of calks for summer or winter wear, and without requiring the removal of the shoe from the hoof.

MANDOLIN.—A. MANNELLO, New York, N. Y. In this instance the tone of the instrument and its clear and distinct notes are improved by constructing the body of two cases, an inner and outer respectively, both cases being substantially the same shape and spaced from each other at both the sides and bottom, the inner case preferably having a number of openings in the bottom for the escape of the sound waves.

SNOW-MELTING APPARATUS.—M. JONASSON, New York, N. Y. This invention pertains to improvements in means for melting and disposing of snow accumulating on sidewalks and in streets, and the aim is to so construct the apparatus that the water resulting from the melting may be delivered to a higher elevation in the building than the snow receiver.

CARRIER.—J. C. H. GERST, Jr., St. Paul, Minn. This device is especially adapted for removing litter and the like from stables, the carrier consisting of a fixed portion which is adapted to take the place of the ordinary gutter at the rear of the stalls, and an elevator proper for receiving the litter from the fixed or horizontal portion and depositing it in a pile remote from the stalls.

FEED-BAG.—H. B. DROSIN, A. DROSIN, and L. DROSIN, New York, N. Y. It is the purpose of this invention to provide a feed bag in which the sides at all times remain stretched out or are non-collapsible in a vertical direction, a bail to suspend the bag from the animal's head, and springs compressed by the weight of the feed in the bag and varying the effective length of the bail.

YARN.—W. P. WOOD, Pawtucket, R. I. This inventor provides a spun or twisted yarn adapted to be used in the manufacture of fabrics having irregular, uneven surfaces, and more particularly provides a yarn spun from cotton or other fiber which when used as a filling will give to the fabric substantially the rough and uneven appearance characteristic of rough pongee fabrics.

DEVICE FOR SPINNING GLASS.—I. WEISKOPF, Morchenstern, Austria-Hungary. The advantages in this case consist in arranging an optional number of means beside one another whereby the output which is possible for one workman is considerably increased. The most important is the use of a fusing point, whereby a small harbor is provided for the fusing glass by which the temperature can be gradually increased up to the melting point of the glass, and dropping of the latter and breaking of the filament caused thereby are prevented.

METALLIC MOLD.—H. G. LARZELERE, New York, N. Y. The purpose of this inventor is to provide a mold for use in building houses and other structures of concrete or other cementitious and like plastic material, the mold being made in sections, capable of being set up and removably connected with each other, to allow the use of the mold for a great variety of work.

REINFORCED PARTITION-WALL. — E. FLAGG, New York, N. Y. The invention concerns itself especially with the mounting and supporting the wire, and with means for rendering the wire taut before the plaster or cement is applied. Partition walls when constructed upon studding have a considerable thickness, and in this way considerable floor space is lost. The wall in this invention can be made very thin and will give a consequent saving in floor space.

PRESSURE-REGULATOR. — J. KENLON, New York, N. Y. The intention here is to produce a regulator to be connected with the hose, and which operates to prevent the bursting of the hose and injury to the men. It will enable the stream passing to the hose to be reduced and regulated when desired, or will enable the full force of the stream to flow unobstructed through the hose.

BOTTLE-LABEL.—I. LEVI, Anniston, Ala. As the liquid is poured from the bottle a ring will sink following the liquid, this sinking movement being permitted by prongs. Should, however, an attempt be made to refill the bottle, the prongs will prevent the upward movement of the ring, which consequently will be submerged beneath the fluid, thus indicating that the bottle has been partially refilled.

VALVE FOR IRRIGATING SYSTEMS.—J. LANG, Clearmont, Wyo. The purpose of the valve is to control delivery of water into the laterals. It is so constructed that the valve proper may be raised so as to allow a restricted, or free, flow of water into a lateral. The valve is not only for vertical adjustment, which is affected by means of a screw shaft, but also to be swung laterally, when it is required to uncover the water inlet or opening to the fullest extent.

SYRINGE.—T. R. MCNERTHNEY, Tacoma, Wash. By the action of gravity and the production of a partial vacuum the combined douche and syringe effect a thorough but gentle embrocation of diseased walls of the "os" and parts, with a medicinal liquid, and then remove the medicament together with pus and other secretions, by a free liquid irrigation of the diseased tissue. It is also serviceable for use in the ear, nose, or other diseased cavities of the body.

Hardware and Tools.

FILTER.—H. P. STRAHL, Cleveland, Ohio. An object of the inventor is to provide a durable filter for filtering air or other fluids, with which, filter material of different kinds can be employed, in which the filter material is securely held in place by adjustable caps, and in which the casing has a head forming a lock nut for one of the caps.

SPECIFIC-GRAVITY BALANCE. — B. R. JOLLY, Raleigh, N. C. In carrying out this invention Mr. Jolly provides a scale by which the object to be assayed may be first balanced in air and then in water by moving the weight farther from the pivot or center of the balance beam. The quality or fineness of the substance may then be determined immediately by means of a scale which is rotated until it reaches a stop, when the reading may be taken directly.

PLIERS.—C. R. COUSINO, Crescent City, Cal. The principal objects in this case are to provide a construction for pliers wherein the clamping jaws are pivotally mounted to operate in substantially parallel lines in closing; to provide a simple and efficient form of construction; and to provide a construction wherein the parts are readily separable for repair or substitution.

SQUARE OR GAGING DEVICE.—J. T. BLAIR, Tulsa, Okla. In this case the invention pertains to a device, the purpose of which is to facilitate the laying out of carpenters' work or similar work, and the purpose is to provide a device by means of which the length and angle of the rafters, hips, and valleys of roofs may be readily ascertained.

NUT-LOCK.—J. MCILWAIN, Okawville, Ill. In the present patent the invention refers to certain improvements in nut locks, and more particularly to that type of nut lock in which a retainer of wire or the like engages within grooves, openings, or apertures in the nut to prevent the latter from turning.

KEY-FASTENER.—C. O. SHAUB, Smithfield, W. Va. The invention relates to key fasteners, and more particularly to such as are adapted to prevent the accidental displacement of a key positioned in a lock, and each of which in general includes a stop, and means for operatively disposing the stop, in a predetermined position to bar the key-hole and prevent the withdrawal of the key.

FASTENER FOR STORM-WINDOWS AND WINDOW-SCREENS.—J. MICHAELSON, Peterson, Minn. The aim of this inventor is the provision of a device which is convenient to apply to a window-casement, and is adapted for reliably holding a storm window or a screen in place within a window-casement, on the inner side thereof, and permit the extra window or screen to be quickly detached from the casement.

FLUE-CUTTER.—W. H. DAMON, New York, N. Y. The invention belongs to that class of a cutter in which a mandrel to fit within the flue is provided with an eccentrically-arranged tool carrying shaft having a limited relative rotary movement to project and withdraw the tool. It is a cutter in which the mandrel has a yoke head and a shaft provided with a thumb-controlled member rigid with the shaft and arranged between the arms of the head.

Heating and Lighting.

LAMP.—C. M. DANIELS, Paris, Ill. Mr. Daniels supports the mixing tube and burner directly from the fuel supply pipe or vaporizing chamber in such a way that the mixing tube and burner may be readily removed. The burner itself is removable from the mixing tube, the construction of the burner and the means for supporting it, constituting another feature of his invention.

SAFETY ATTACHMENT FOR GAS-LIGHTING BURNERS.—H. E. CAMPBELL, New Haven, Conn. The principal objects in view are to provide an attachment wherein the heat of the flame maintains the flow of gas; to provide an operating medium which will not become frozen or lost by evaporation; and to provide a construction simple and efficient in its operation.

FURNACE-GRATE OPERATING MECHANISM.—H. BEVAN, Burlington, N. J. The grate is depressible from the bottom of the fire-box to empty the latter and provide space for the insertion of a gas ring, as in the spring and fall when heating the house for a portion of the day. The invention further contemplates locking of the grate when raised and the locking of the grate shaking means when the grate is depressed, to provide a fixed rest on which the gas ring may be slid to position of use.

WATER-TUBE BOILER.—W. S. LUCAN, Marshall, Ill. The intention of the inventor is to provide a boiler designed for use in generating steam for motive power or for heating buildings by steam or hot water, and arranged to provide an exceedingly large heating surface and to use the fuel economically and to the fullest advantage.

AUTOMATIC CUT-OFF FOR GAS-MAINS.—C. E. LAHMERS, New Philadelphia, Ohio. This device is for use in preventing explosions or accidents caused by the changes in the pressure in gas mains. One object of the invention is to provide a device which will automatically shut off the flow of gas from the mains when the pressure therein becomes too low, thereby preventing the accidents which otherwise might occur.

GAS-FIXTURE. — A. JARMOLOWSKY, New York, N. Y. In view in this present invention is a construction in which the lighter, as it is revolved, moves the controlling valve to turn on the gas to the several lights or burners in successive order, the flow of gas in each burner starting at the time the burner is reached by the lighter. It is an improvement on a former patent granted to Mr. Jarmolowsky.

Household Utilities.

AUTOMATIC DAMPER-OPERATING DEVICE.—F. H. MULLER, Lanscale, Pa. This invention provides novel means for simultaneously operating the dampers of a cooking stove or range at a predetermined time, so as to start a smoldering fire therein into free burning condition, and means for sounding an alarm at the same time the dampers in the range are adjusted to produce free draft therein.

JAR-HOLDER.—O. F. PETERSON, Keokuk, Iowa. The aim of the invention is to provide a device serviceable in construction and inexpensive to manufacture, which can be easily mounted on a receptacle, such as a pan or the like, and which serves to hold a number of preserve jars in place while the latter are being filled.

BRACKET FOR SUPPORTING CURTAIN-POLES AND SHADE-ROLLERS. — A. S. DEBOSS, Springfield, Ill. Brackets have been constructed which support poles and rollers, so that they combine two functions, but they have been made of so many parts and otherwise constructed in such manner as to be comparatively expensive and unsatisfactory. In the present bracket all the parts save the hook which serves to support one end of the roller, and the rod and spring, are formed integrally or in one piece, and may, therefore, be produced at minimum cost.

WASHING-MACHINE ATTACHMENT FOR STATIONARY WASHTUBS.—W. WALTON, Jr., New York, N. Y. The invention is an attachment for tubs, and is designed to provide a washing apparatus embodying a washing cylinder which may be readily applied to and operated in stationary tubs of various sizes, and the cylinder easily removed when desired to use the tub in the usual manner.

MATTING-ROLLER.—A. E. SHANNON, Columbus, Ohio. Matting is comparatively stiff and has a slippery surface, difficult to roll upon a bar or spindle. This inventor has attained success with the present invention, that is to say, with a bar or spindle formed of spring material and having a lengthwise slot in which a block is inserted and permanently held and serves to separate the halves of the spindle more widely than normally

AWNING-FIXTURE. — J. SULLIVAN, New York, N. Y. A purpose here is to provide a fixture, one which will obviate the necessity of attaching the upper portion of the fixture to the window casement, and one wherein a person standing on the window sill, or operating from a suitable point in the room, may conveniently and almost in a moment place the awning in position for immediate use.

WASHING-MACHINE CYLINDER.—J. R. GOLTER, Greensboro, N. C. In this machine the brace ribs operate to strengthen and support the perforated jet ribs. The latter tend to cause the water to pass through the perforations with force as the cylinder revolves in the water, thereby making it easier to mix the washing ingredients with the water and facilitating such mixing and the washing process.

Machines and Mechanical Devices.

LOG-HANDLING DEVICE.—J. G. STONER, Smithsburg, Md. The object here is to provide a device for use in connection with sawmill carriages and the like, which can be arranged adjacent to the carriage to assist in turning the log by means of a cant hook or similar device, and which prevents the possibility of the log being displaced from the carriage while it is being turned.

BRAKE-LEVER MECHANISM FOR CARTS AND WAGONS.—G. MANLOVE, Rushville, Ill. More particularly the invention concerns itself with that form of brake lever mechanism which comprises a segment with which a lever co-operates by means of a pawl, so that the pawl will hold the brakes applied when the lever is thrown over to the braking position.

STUMP EXTRACTOR.—A. P. BERNIS and E. J. WARE, Portland, Ore. This machine extracts stumps or similar obstructions from the ground. The object of the invention is to provide a machine which is simple in construction, having means whereby the device

may be anchored, and improved means for attachment to a stamp or other obstruction which is to be removed.

ROCK-DRILL.—L. F. Sleade, Denver, Colo., and W. A. Sherwood, Courtland, Ariz. In the present patent the improvement relates to drills, the more particular purpose being the provision of a type of drill especially suitable for work in rock and similar hard substances, and possessing a number of constructional advantages whereby its utility is greatly increased.

MACHINE FOR MAKING COMPOSITE FABRIC.—E. Strauss and W. R. Erskine, New York, N. Y. An object here is to provide means for delivering a plurality of layers of material under proper tension, to an assembling and folding device. Further, to provide means for delivering a plurality of layers of material to a compressing device in a peculiarly assembled relation and under a proper tension.

BRISTLE-DRYING MACHINE. — E. R. Zehner, Toledo, Ohio. The intention in this case is to produce a machine which can treat a large quantity of bristles, and which operates in connection with a drying current of hot air. The bristles are treated in such a way that they are turned over and over so that they become uniformly exposed to the heat during the drying process.

PNEUMATIC RELAY FOR AUTOMATIC MUSICAL INSTRUMENTS.—A. W. Lonsdale, 22 Woburn road, Bedford, England. The invention relates more particularly to relays such as are commonly employed in the "actions" of automatic piano-players and similar instruments or adjuncts thereto. The feature consists in the fact of the secondary valve being so mounted and guided as to be completely free to seat itself fairly upon the surfaces with which it alternately makes joint.

BREAKING OR GRANULATING MACHINE.—J. H. Spencer, New York, N. Y. For the purpose of granulating or breaking the meat of nuts and other material without bruising or crushing, use is made of stationary spaced jaws, and movable jaws adapted to pass between adjacent fixed jaws, said fixed and movable jaws having tapering sides, and the wider faces of the fixed jaws being uppermost and the wider of the others being lowermost at their passage between the fixed jaws.

TYPE-WRITER ATTACHMENT. — D. F. Maher, Watsonville, Cal. It is sometimes desirable to dictate directly to the typewriter so that the letter may be written at once without the intervention of a stenographer. In so dictating much time is lost by the one dictating and the operator and Mr. Maher seeks to devise a simple alarm device whereby the operator may indicate to the dictator when the latter may proceed with the dictation.

TYPE-WRITER STAND.—C. E. Goulding, Tampa, Fla. The objects here are: to provide means whereby heavy records may be held in view of the operator while operating; means whereby the pages may be secured or clamped in flat position upon the copy holder; means whereby successive lines may be accurately followed by the operator; and means whereby the heavy and cumbersome record may be shifted easily.

MECHANICAL MOVEMENT. — F. L. Bowles, Jersey City, N. J. The movement is of special value in connection with flying, rowing, and exercising machines, and in various other relations wherein it is desirable to cause a reciprocating member to feather in an arbitrary manner, for the purpose of producing an efficient stroke.

CLUTCH.—W. E. Knoell, Minneapolis, Minn. This clutch will automatically release at the first revolution of the shaft after engagement. The invention is particularly adapted for use in the class of machines wherein a single rotation of the driving pulley is desired, and wherein the timing of such rotation is manually controlled.

HANDLING-MACHINE FOR BASKETS.—F. L. Haberle, Jacksonville, Texas. This simple machine will operate automatically to feed in the wire stock, cut the wire to the proper length, and form it into a handle. The machine then operates to attach the handle to the basket and clenches it in position.

GAGE FOR DETERMINING THE VELOCITY OF FLUIDS.—F. H. Crawford and M. B. Carmody, Columbus, Ohio. The velocity of fluid may be ascertained with a knowledge of the statical pressure in one-half of the gage, by determining the variation of the levels in the two halves of the gage, which is readily determined by examination of a dial, over which travels a hand which is secured to the gearing. A scale and glass tube are also provided for use when placing the fluids in the lower portion of the gage.

PROPELLER.—F. C. Gordon, Cleveland, Ohio. In this propeller the blades are reversible so that the shaft while turning continuously in one direction may be made to turn the vessel ahead or astern as desired. The invention provides a casing for the blades, the casing constituting not only a protective and returning part but a bearing part as well. It is an improvement over a similar device in a patent formerly granted to Mr. Gordon.

BEER-DISPENSING APPARATUS.—W. A. Wentzell, New Albany, Ind. One of the objects of this improvement is to provide a device by which the manipulation of simple mechanism may cause the return of beer to the kegs, the cleaning of the coils, pipes and faucets, and the draining of these parts, thereby leaving the apparatus clean and ready for subsequent use.

ROAD-WORKING MACHINE.—E. B. Winters, Coffeyville, Kan. The invention pertains more particularly to such machines as are used for grading roads, and which include substantially parallel beams carrying scraper blades adapted to engage the road surface, and means whereby the pitch of the blades may be adjusted to alter the depth to which they shall sink into the road surface.

BUSH-HAMMER.—J. H. Sweetland, Hall Quarry, Maine. The inventor's aim is to provide means to more securely hold the teeth or blades in the head of the hammer, so that any lateral movement of the teeth or blades may be prevented, while at the same time it is possible to replace the teeth cutter with little trouble.

Prime Movers and Their Accessories.

CONDENSER-PUMP. — P. J. Pennings, Kiel, Germany. According to the invention, the pressure chamber of the pump for the water of condensation is adapted to take up the air primarily compressed in the air pump and to raise the pressure of said air to that of the atmosphere. The pump used for the water of condensation is of the single acting type.

Railways and Their Accessories.

SAFETY DEVICE FOR RAILROAD-FROGS.—J. T. Watson, Osage City, Kan. This device is adapted to prevent a person walking on the railroad from catching his foot in a frog on the track, thus preventing the numerous accidents due to persons wedging their feet between the rails and being unable to extricate themselves before being run down by fast-moving trains.

RAILWAY TIE AND RAIL.—I. J. Gray, Lawrence, Kan. This invention relates to railway ties and the object of the inventor is to produce a tie which is particularly adapted to be formed of metal, and to provide a special construction of rail which facilitates its attachment to the tie. A further object is to provide special means for insuring that the tie will keep its shape. The railway ties constructed as intended can be readily formed from light sheet metal.

CAR-MOVER.—F. C. Bailey, Rib Lake, Wis. The object here is to provide a device which is simple and serviceable in construction and inexpensive to manufacture, which will automatically clamp itself on a rail to give a firm support for the lever as the latter is operated to advance a car along the tracks.

SIGNAL.—R. C. Spoor, Hastings, Colo. An object of this inventor is to provide a railroad signal which can be removably mounted upon railroad locomotives, cars or the like, or on or near the railroad track, which can be reversed to present a different appearance or color, which can be easily cleaned when soiled, and which can be manipulated rapidly and easily.

MINE-CAR WHEEL.—J. T. Parks and M. T. Davis, Jr., Charleston, W. Va. The main purpose of the present invention is to make use of a plug for holding the wheel on the shaft, with improvements for loosening the plug if the latter should become jammed against the shaft. Further, to provide a plug for keeping the hub on the wheel which is not subject to the danger of rotating out of place, but which is held in place by means of an extension.

MERCHANDISE-TRANSFER SYSTEM.—G. Macartney, St. Paul, Minn. Generally speaking the invention consists of one or more unloading platforms, with one or more railroad tracks located adjacent thereto, and a plurality of loading platforms with tracks adjacent thereto, and with interconnecting tracks adjacent to said loading and unloading platforms, the relative heights of the railroad and miniature railroad tracks and platforms being so arranged that the floors of the cars on the various tracks will extend in substantially the same level as the floors of the adjacent platform.

RAIL CONNECTION.—H. Grass, Alvin, Texas. It is the usual practice to connect the meeting ends of rails by means of heavy fish-plates and screw bolts, leaving such ends otherwise entirely unsupported between adjacent cross-ties. The object of the inventor is to prevent certain results due to the above and other arrangements of imperfect and objectionable connections between rail ends and the lack of due support therefor.

ELECTRIC CONDUCTOR FOR RAILWAYS.—E. W. Enequist, New York, N. Y. Primarily the object here is to provide in connection with one or both of the traffic rails of an electric railway, i. e., one of the rails on which the rolling stock travels as contra-distinguished from other rails, an electric conductor or conductors for feeding the car motor, thus dispensing with the usual third rail or overhead wire conductor and avoiding many of the dangers and inconveniences resulting therefrom.

JOURNAL-BOX-LID FASTENER.—T. H. Joye, Charleston, S. C. The improvement is in boxes for railroad stock, and resides in the construction of the lid and the parts of the body co-operative therewith to lock the lid in closed position, limit its sliding movement in the opening of the box, force the lid when closed, in a direction to bind the lid to the box body, and when open to frictionally retain the lid in an open position, and in constructing the box so that the locking means can be disengaged only by a special key.

Pertaining to Vehicles.

VEHICLE BRAKE.—F. A. Eigenmann, Newark, Ohio. The aim in this case is to provide a brake for use in connection with motor vehicles and the like, by means of which the vehicle can be brought to a sudden stop without arresting the rotation of the driving wheels, so that the strain upon the motor, incident to the sudden application of the ordinary brakes is obviated.

RUNNING-GEAR FOR WAGONS.—W. J. Ott, Merlin, Ore. In the present patent the purpose of the invention is to provide novel details of construction for a freight hauling wagon, which are light, strong and durable, enable a quick turning movement, largely prevent destructive wear, and that may be produced at a moderate cost.

MOTOR.—G. Keller, New York, N. Y. The object here is to provide a motor or explosion engine of the two-cycle type arranged to utilize the motive agent to the fullest advantage by giving continuous impulses in proper rotation to a plurality of pistons connected with the main shaft, to insure a steady and uniform running of the engine and hence permit the use of the motor on automobiles and the like.

ANTISKID ATTACHMENT FOR VEHICLE-WHEELS.—T. T. Chaloner, New York, N. Y. The inventor's object is to provide a device, several of which are adapted to be attached at intervals to a wheel of an automobile or the like, to protect the tire and at the same time prevent the wheel from skidding.

VEHICLE-TRUCK OR RUNNING-GEAR.—W. S. Wills, Covington, Va. The improvement is in trucks and running-gear, whereby the inventor reduces and distributes the jar or shock incident to contact of the wheels with obstacles in the road-way, and whereby the vehicle bed or frame to which the truck proper is attached will not be lifted as much as that one of the wheels which may pass over an obstruction. Thus in a vehicle provided with this attachment, springs may be dispensed with.

JOINT-COVER.—A. G. Williams, Sidney, N. Y. This cover for protecting a ball joint, comprises a flexible sleeve adapted to be opened out in the form of a flat sheet and provided with an opening on its side, with the walls of the opening formed of an elastic material and adapted to be expanded over the ball of the joint and closely fit around the member to which the ball is secured.

VELOCIPEDE.—M. Slotkin, New York, N. Y. Through the medium of the clutch a continuous movement can be imparted to the driving axle, and when two clutches and accompanying parts are employed the forward motion of the vehicle will be positively uninterrupted, and when a single clutch is used the momentum of the vehicle after one movement of the pedal or lever will carry it forward until the clutch is again brought into active operation.

LOADING-MACHINE.—G. Kruse, George, Iowa. This machine is especially adapted for loading manure into a wagon. An object of the invention is to provide a device capable of lifting large loads and of depositing them in a waiting vehicle wthout the use of engines or other power generators, the action of the machine depending entirely upon the power supplied by hand.

CARRIAGE-LAMP BOX.—R. E. Cole, Democracy, Ohio. The object of the invention is to provide a box or case, to be secured beneath the bottom of a buggy, to carry an ordinary stable lantern, so that the lantern may act as a carriage lamp while driving, and as a lantern when out of the buggy or carriage, and to serve also as a heater for the buggy or carriage.

Designs.

DESIGN FOR A FABRIC FOR WINDOW-SHADES OR SIMILAR ARTICLES.—A. A. Boeck, New York, N. Y. The design presented in this case is an original arrangement of vertical and cross lines which show an ornamental effect heightened by alternating the density of the rows of patterns. Mr. Boeck has designed another arrangement of cross and vertical lines embodying some of the effects of the denser band in the former design.

DESIGN FOR FABRIC. — D. Valentine, East Orange, N. J. In this fabric design the brilliant effect is produced by a broad mass of solid round discs one-quarter of an inch in diameter on a white background. The discs do not quite touch and are in perfect alignment, with a white line running through the centers of the discs up and down and across.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12174) H. T. VanP. asks: 1. How longitude or sidereal time is determined by the moons of Jupiter? A. Longitude is determined from the eclipses of the moons of Jupiter, by having a table of these eclipses in Greenwich time. This is published every year in the Astronomical Ephemeris by the United States Naval Observatory, Nautical Almanac Division. The moment of the occurrence of an eclipse is observed in local time. The difference between the local time of occurrence and the Greenwich time of the same eclipse is the difference of longitude required. 2. Is there a formula for getting the equation of time without using tables? A. The equation of time is the difference between the time of the true sun and that of the mean sun. Tables are given for it in works on astronomy. One may be found in Todd's "New Astronomy," which we send for $1.50. This gives the equation of time for each five days in the year. 3. Having the tables of the equation of time for one year, say 1909, can the equation of time be determined for the next year or any year following? A. The equation of time is the same for each year. A table for one year is the same as for any other.

(12175) W. P. says: Would you please inform me what are dry cells composed of? What is the chemical used in them and how can I recharge them when their powers get diminished or worn out? A. There is little to be gained in recharging dry cells, if time or money are considered. The cement may be broken out at the top and a strong solution of salt ammoniac may be put in and allowed to soak down through the cell. This will take considerable time. Others have punched holes in the side of the outer jaw and set this in a glass battery jar which is filled with the sal-ammoniac solution. You will find in our Supplements 1383 and 1387, price ten cents each, valuable articles upon the making of dry cells. It would be better to make new cells than to repair old ones.

(12176) M. R. says: We are told that the earth spins around, making one revolution every 24 hours, which is really very fast for so large a ball. Does the envelope of air which surrounds the earth turn with the earth as though it were a part of the earth, the winds which we experience being minor disturbances in the lowest stratas of the atmosphere? If this envelope does turn with the earth as though the two were one, can you tell me why it does so? If it does not, why do we experience at times perfect calm on some of the highest points of the earth's surface? I would like to get a convincing answer, either one way or the other. A. The air is a part of the earth, and a very heavy part of the earth. The weight of air above each square inch of the surface of the earth is 15 pounds, with some variations from time to time. This gives for the weight of the whole atmosphere 5,000,000,000,000,000 tons. The air moves with the earth as it rotates. If it did not, we should have an east wind at the equator all the time blowing 1,000 miles an hour. This would tear everything off the earth and leave it a barren mass of stone. The winds which we have are due to the heat of the sun. Davies' "Elementary Meteorology," which we send for $2.50, will give you much information on such topics.

(12177) T. O. W. says: Will you kindly tell me if metal reinforcements have ever been successfully inserted and used in such materials as sewer tile where the clay was burned and glazed? Would it be possible to use iron in this way, or would the iron oxidize and also expand too greatly? A. We have no information as to metal reinforcement having been used in baked clay tile, but have no doubt that it can or could be so used, since it is satisfactorily used in glass. The difference between the expansion of iron and that of pottery is too small to set any internal stress when the former is imbedded in the material of lower heat conductivity and the metal sufficiently protected from oxidation as in concrete.

(12178) W. V. L. says: Will you recommend a paper on the subject of babbitting journal boxes for machinery? I am especially anxious to learn best method of pouring babbitt around a shaft, leaving a solid box and yet leaving the shafting loose enough to turn free and easy. You know it always shrinks tight on the shaft if the journal has not been treated in some way to prevent as the babbitt cools. I get along very well with split boxes, yet there is much about this I would like to have a good article on. Is there any process by which babbitt may be made to solder or mold to the inside of the cast iron box? Can they be tinned by the use of acid and the soldering iron as copper, so that the hot babbitt will adhere while it is being poured? If you have numbers of the Supplement covering this im-

portant subject of Babbitting Boxes in general, will you please point them out to me? A. We regret that we have no SUPPLEMENT numbers exactly covering the point you mention. A babbitt composed of 1 part of antimony to 4 parts of lead has excellent anti-friction properties, is hard, and shrinks almost not at all on cooling. The writer has had good success in casting solid bushings or boxes around small shafts with the above, and even with bronze, by coating the shaft thickly with lampblack (from a miner's hand lamp burning lard or similar oil), and then pouring the metal around it. The lampblack being pure carbon, makes as good a lubricant as graphite when mixed with oil.

(12179) F. H. says: Will you please settle a dispute that has arisen on the following subject: A claims that it grows colder the deeper we go into the earth, basing his argument on the fact that cold water oftenest comes from deep wells and that a certain iron mine is very cold at its greater depths, so much so that visitors are given overcoats to wear before taken down. B claims that A's argument is entirely fallacious and based on special conditions; that the fact is that the temperature increases as we go down into the earth, approximately at the rate of one degree for every fifty feet. A. It is a well-known fact that the temperature rises one degree for every 50 to 60 feet which we go down in the earth below the level of unchanged or constant annual temperature. That there are cold springs is of course true. There are also hot springs, boiling hot springs, in many places on the earth. And the general statement which we made above is certainly true. The subject is treated in all textbooks of geology. We can sent you Scott's, one of the most recent and best, for $2.80 postpaid.

(12180) L. F. says: Please tell me what constitutes a horse-power for the steam engine, and from what did the name horse-power originate? What is vacuum? A. The term horse-power means, as the name implies, the power of a horse, and was established by James Watt, in order that he might have some basis of comparison of the power developed by his engines. He measured the work done by a heavy London draft horse of the Clydesdale or similar variety, during short intervals, by observing the weight it could lift against gravity, the horse of course walking on the ground and pulling horizontally on a rope led through pulleys, so that the weight rose vertically. The unit horse-power, so established, was 550 foot-pounds of work per second or 33,000 foot-pounds per minute, i. e., 33,000 pounds raised one foot in a minute, 330 pounds raised 100 feet, or 1 pound raised 33,000 feet per minute; but whereas few horses could do that amount of work for more than a few seconds together, a 1 horse-power engine will go on producing that amount of work indefinitely so long as it is supplied with steam.

(12181) W. K. B. says: I am interested in knowing what kind of satisfaction dry colors ground with crude oil would give used as a cheap paint for such buildings as barns, etc. My idea is to let the crude oil take the part of linseed oil, the use of which would greatly reduce the price of this class of paint. I am told by a painter that he used to work in the oil districts at his trade and that he had used a great deal of this kind of paint. A. The experience of your friend who has tried it may be a better guide than our theory, but we should not say that the mixture of pigment with crude petroleum would form a satisfactory paint from any point of view except that of first cost. Crude oil is not colorless or transparent and would discolor the more delicate pigments, making yellow, for instance, a rather dirty green. Then again, linseed oil has the property of increasing in weight upon oxidation by exposure to atmosphere, thereby adding to its protective value; whereas the only constituents of petroleum preservative to metals from corrosion are volatile, and upon evaporation of its oils the paint made from it would have no value unless the pigment itself were preservative and capable of hardening into a continuous coat.

(12182) C. A. R. B. says: 1. Please inform me what weight a thousand cubic feet of hydrogen will sustain. A. One thousand cubic feet of hydrogen will sustain 70 pounds at normal barometer at sea level and the freezing point, 32 deg. Fahr. 2. The weight of a cubic foot of air at sea level and at 5,000 feet altitude, if you have the information at hand. A. A cubic foot of air at normal barometer and 32 deg. Fahr. weighs 0.08071 pounds. At an altitude of 5,000 feet under the same conditions the air will be about five-sixths as heavy; that is, when the barometer is normal at the sea level, at 5,000 feet above the sea the barometer will stand about 25 inches, or five-sixths as high.

(12183) J. M. K. says: As a reader of your valuable paper I would like to ask the following queries: 1. Is a mercury incubator thermometer liable to break or crack on being exposed to a sudden change of temperature from 104 deg. F. to 32 deg. F.? A. A mercury thermometer should not break by a sudden change from 104 deg. to 32 deg. Still it is not necessary to plunge such a thermometer into ice to test it. Make the change gradually and give time for the glass to take the new temperature. 2. How can I change a telephone generator into a dynamo? A. If a telephone generator is run by power it will be a magneto generator. It is provided with permanent magnets and does not require a field winding.

NEW BOOKS, ETC.

THE ART OF THE BELGIAN GALLERIES. By Esther Singleton. Boston: L. C. Page & Co., 1909. 12mo.; 369 pp. 48 plates. Price, $2.

The author has produced a most readable book, which will be valuable to the visitor to the galleries of Antwerp, Brussels, and Bruges. The book is intended for a help to the student in tracing the course of Flemish art by the notable pictures to be found in the Belgian galleries. The introductory part contains short biographies of the chief masters whose works are contained in the galleries, and descriptive matter relative to their places in the course of Flemish art, together with some description of their individual art and their influence on others. In describing the art of the individual galleries, the general plan has been to deal first with the masterpieces of the collection and the works of the greatest masters, grouping the latter irrespective of subject. The illustrations are admirably selected, and are beautifully reproduced in warm sepia tones. In comparing this volume with the preceding one on "The Art of the Netherland Galleries," the effect of religion on the development of the schools is very marked; for while the Protestant Dutch were painting portraits or scenes of domestic life, as well as landscapes, the Roman Catholic Flemings were still painting large pictures of religious subjects in the old spirit of devotion. Now that the whole world is turning with more and more interest to old Dutch and Flemish pictures, this volume will prove of great interest.

CHATS ON OLD SILVER. By E. L. Lowes. New York: Frederick A Stokes Company, 1909. 12mo.; 320 pp. Price, $2.

This sumptuous book is freely illustrated by 54 full-page illustrations and numerous line drawings in the text. There is also a colored frontispiece. The subject is a most fascinating one, for among all the objects of fine art which the amateur collects, there is nothing which is so easy to acquire and so satisfactory as old silver. Fine furniture, choice prints, and goodly pictures are objects greatly sought after, but they must be fine and bear the outward and visible sign of some master hand to be worth collecting. They have also to bear the constant risk of deterioration, to withstand the continued fluctuations of taste, and consequent rise and fall of the market; whereas old silver on the contrary has sound foundations; there is no doubt about its date and market value. It is writ so large that he who runs may read. The making of a collection of old silver is literally within the means of the middle-class collector. The author knows his subject well, and treats the same with a breadth which is truly refreshing in a book for collectors by a collector. The text is printed on beautiful light-tinted paper most agreeable to the touch and to the eye, while the inserted plates are printed on the whitest of coated paper. The section relating to hall marks and date letters is most valuable. The sale prices which are appended give valuable indications of the market during the last few years.

THE SLIDE RULE. An Elementary Treatise. By J. J. Clark, M.E. Scranton, Pa.: Technical Supply Company. 18mo.; 62 pp. 1 plate.

The author has been approached many times by engineers owning a slide rule, but who are practically unable to use it, with a request as to how to use it in certain cases. This has served to demonstrate that the instructions studied were not understood, and that they were so difficult, meagre, or ambiguous that the reader did not have patience to study them until he had mastered the intricacies of the rule. This is very true; for of the slide rules in existence many are not put to anything like their full use, owing to the fact that the principles have not been thoroughly mastered. To the person who thoroughly understands three or four of the leading principles, the slide rule is a wonderfully simple and easily operated instrument. It is not necessary for him to remember any settings, and he can solve any case with ease and precision. Bearing this in mind, the author has endeavored to explain these principles so thoroughly that they cannot be forgotten, and in such a manner that anyone with a fair knowledge of arithmetic can readily understand them. The writer of this review may state that his slide rule has been given added value after a perusal of this little work.

DOCKHAM'S AMERICAN REPORT AND DIRECTORY OF THE TEXTILE MANUFACTURE AND DRY GOODS TRADE. Boston: Dockham Publishing Company, 1909. Quarto; 642 pp. Price, $6.

This is the twenty-second edition of the forty-third year of this most valuable publication. There is no subject more difficult to deal with than the question of textile manufacture, and this is the only book which will solve many of the difficulties. It has many excellent points, such as statistics on the looms in the United States, the number of cotton spindles, sets of wool cards, worsted combs, etc. There is also a list of textile manufacturers arranged alphabetically by States, including Canada and Mexico also. There are separate lists for bleacheries, cotton dealers, cotton goods manufacturers, wholesale dry goods, dryers, finishers, and mercerizers, exporters, importers, print works, wool dealers, wool-hat manufacturers, and yarn dealers.

WIRELESS TELEGRAPHY AND HIGH-FREQUENCY ELECTRICITY. By H. La V. Twining, A.B. Los Angeles, Cal.: Published by the author. 8vo.; 202 pp. Price, $1.50.

The many amateur wireless-telegraph operators in this country use induction coils rather than transformers because the induction coil is convenient and because very little has been written on the subject of small transformers adapted for their particular uses. The author of the present work goes into the subject of building transformers to take the place of induction coils, and supplies the data necessary for building fourteen sizes of transformers of from one hundred watts to five kilowatts. While the theory of wireless telegraphy and high-frequency apparatus is explained, this is done in a very simple manner, so that it can readily be understood by those who have not had a course in electrical engineering. The construction described are eminently practical, and the result of the author's own experimental work.

CHATS ON OLD EARTHENWARE. By Arthur Hayden. New York: Frederick A. Stokes Company, 1909. 12mo.; pp. 496. Price, $2.

This beautiful book is accompanied by 150 illustrations and tables of over 200 illustrated marks. Five years ago the author published "Chats on English Silver" which was warmly received. A great number of readers wrote to the author suggesting that he should write a companion volume dealing with old English earthenware. The collection of old English earthenware, in the main, is still within the reach of those who have slender purses, while English china within the last decade has reached prohibitive prices. After a bibliographical sketch, comes a glossary, then a chapter on "How to Collect, for Beginners," which is extremely valuable. This is followed by chapters on Early Ware; English Delft; Stoneware; Early Staffordshire Ware; Slate Glazed Ware; Josiah Wedgwood, Leeds, and other factories; Transfer Printed Ware; Staffordshire Figures; Swansea and other factories; Lustre Ware; and Late Staffordshire Ware. There are valuable lists of prices appended to every chapter. The book is very handsomely made and is sure to merit the attention of all collectors.

POTTERY OF THE NEAR EAST. By Garrett Chatfield Pier. New York: G. P. Putnam's Sons, 1909. 12mo.; pp. 175, 64 illustrations. Price, $5.50 net.

Many choice and remarkably preserved examples of the ceramic wares of this section of the Orient have recently reached our markets, examples distinctive in material, form, and ornamentation. Among these were found certain pieces of more than usual interest, since they provide us with new facts in regard to the dating of certain of these early mediæval ceramic productions. To present these facts as concisely as possible is the purpose of this monograph, which, it may be added, deals with the Muhammedan wares of every section of the Near East, with the single exception of these of Saracenic Spain, so ably treated of by Dr. Van de Put.

CATALOGUE OF THE WORKS OF ART BELONGING TO THE CITY OF NEW YORK. New York: Prepared and issued by the Art Commission of the City of New York, 1909. Large 8vo.; pp. 241.

The City of New York began its valuable collection of portraits in 1790 by requesting Gen. Washington to permit Mr. Trumbull to take his portrait to be placed in the City Hall as a monument of the respect which the inhabitants of this city had toward him. Since this time the city has been acquiring works of art of all kinds. Technically these works of art are under the charge of and they are passed upon by the Art Commission of the city of New York. The constitution of this commission is most admirable. Its present members are: Robert W. De Forest, Frank D. Millet, John B. Pine, George B. McClellan, A. Augustus Healy, John Bigelow, Arnold W. Brunner, Charles Howland Russell, Fred B. Pratt, and Herbert Adams. Thus we have artists, sculptors, officers of literary and artistic societies and museums, as well as a painter and a sculptor. If it were not for this estimable body the city of New York would have foisted upon it most atrocious works. This commission is an artistic safeguard of the city. The book is a beautiful one, magnificently printed, and it gives a complete *catalogue raisonné* of all the works in the possession of the city, numbering several hundred. The plates are superbly executed.

THE STORY OF DUTCH PAINTING. By Charles H. Caffin. New York: The Century Company, 1909. Square 8vo.; pp. 200. Price, $1.20 net.

The tale of how the Dutchmen of the seventeenth century developed a new school of painting is a part of the story of the lives and fortunes of the Dutch people; and to know something of the latter helps to appreciation of what these Dutch painters tried to do, and how they succeeded. Mr. Caffin tells what the principal Dutch artists accomplished in portraiture, in landscape, and in the representation of the indoor and outdoor life of the people, why they chose these subjects, and why they treated them as they did. The result is a complete and readable handbook of Dutch art, equally appealing to wide-awake young people and to adult students of art. The reproductions of notable Dutch paintings add to the volume's value and interest.

IN WILDEST AFRICA. By Peter MacQueen, F.R.G.S. Boston: L. C. Page & Co., 1909. 12mo.; pp. 402. Price, $3.

This is a description of a hunting and exploring trip through Uganda, Victoria Nyanza, the Kilimanjaro region, and British East Africa, with an account of an ascent of the snowfields of Mt. Kibo in East Central Africa, and a description of the various native tribes. The book is admirably illustrated by a very valuable series of 64 plates from the original photographs taken chiefly by the author's traveling companion, Peter Dutkewich. It is also accompanied by a map showing the district under discussion. The publication of this book is timely, owing to the appearance of the interesting articles by ex-President Roosevelt covering the same ground. The contribution of Mr. Dutkewich, who is a Russian by birth, but who has lived most of his life in America, is most unique. He is a professional outdoor photographer and has made 12,000 negatives in all parts of the country. The author's text is clear and interesting and is an admirable exposition of life in this wildest part of the globe. Equatorial Africa is one of the most fascinating countries in the world. It allures and repels; it is beautiful as an opium dream, baneful as nightshade. One day a man is well and strong; the next he is dead and buried. But just as the Americans improved the conditions in Cuba and Panama, so will the English, French, and Germans probe into the sombre mysteries of Africa, dispel the clouds with which it has been draped for five millenniums, and make it, in a few decades, a land of light, learning, and liberty. Few seem to realize that Africa is no longer the "Dark Continent."

THE ELEMENTS OF MACHINE DESIGN. Part I: General Principles, Strength of Materials, Rivets, Bolts, and other Fastenings, Journals and Shafting, Couplings, Pedestals, Transmission of Power by Gearing, Belting, Ropes, and Chains. By W. Cawthorne Unwin, LL.D., F.R.S. New edition, revised and enlarged. London: Longmans, Green & Co., 1909. 8vo.; pp. 531. Price, $2.50.

This treatise is intended to occupy a distinct field between works on applied mechanics and empirical books of rules and examples of machine details. In common with the former the scientific rules applicable to, and the design of machines are given, with such an amount of clearness and explanation as is necessary to make them intelligible to readers acquainted with the general purpose of mechanics. It has been aptly said that the engineer is a man who is continually being called upon to make up his mind, but whatever it is, after it is once decided it is irrevocable, for it is transmitted into steel, iron and copper, and cannot readily be revoked. It therefore behooves the engineer to be posted at every possible point. The book is a very valuable one, and the fact that the practice is English does not seriously militate against it.

SPRING FLOWERS AT BELVOIR CASTLE. By W. H. Divers. London: Longmans, Green & Co., 1909. 8vo.; pp. 193. Price, $1.80 net.

Belvoir Castle is one of the finest country seats in England. The author is head gardener to his Grace, the Duke of Rutland. Owing to the large number of inquiries which he has received concerning the cultivation of the spring bedding plants in this garden he has been induced to write this beautiful little book, which is a charming exposition of what landscape gardening really means. The author hopes that many others will be led to cultivate these interesting and beautiful plants more extensively, and thus make their gardens more beautiful in the early months of the year. These hardy plants appeal to a large number of persons, not only because of their beauty when seen in a mass, but because of their low cost and the small amount of labor required to take care of them during the summer months and for transplanting them in the autumn. Thus they are adapted for everyone who has a garden. The illustrations are from photographs taken by the author. They show that he is not only an expert gardener, but a photographer of no mean order.

PRACTICAL HOUSE FRAMING. By Albert Fair. New York: Industrial Book Company, 1909. 108 pp.; 98 illustrations; 12mo. Price, 50 cents.

The series of articles on house framing was recently published in The Practical Carpenter. Mr. Fair, the author of these articles, has prepared them in the form of a practical text book for beginners and a reliable guide for journeymen. It takes up the subject of braced frame construction, containing many useful hints and suggestions on these forms of house framing.

HOW TO MAKE TABLETS. By Frank Edel. Boston: The Spatula Publishing Company. 24-page pamphlet. Price, 25 cents.

Among the products of modern pharmacy none are more popular than compressed tablets, and it is a very easy matter for the ordinary druggist with a small expenditure to make tablets which are better than those of the larger manufacturers.

QUESTIONS AND ANSWERS ON THE PRACTICE AND THEORY OF SANITARY PLUMBING. Vol. I: Drainage and Venting. Ninth Edition; revised and enlarged, by R. M. Starbuck. Hartford, Conn.: The Bond Press Company, 1909. 16mo.; pp. 154. Price, $1.

This little volume has passed through a number of editions, each one of which has been presented to the reader in a more valuable form than the preceding one. The original purpose was to present the subject in as concise, brief, and practical manner as possible. The popular question-and-answer system is employed.

HINTS FOR CARPENTERS. Compiled and edited by Albert Fair. New York: Industrial Book Company, 1909. 12mo.; 144 pp.; 101 illustrations. Price, 50 cents.

This is a collection of practical hints for amateur carpenters and joiners, and explains how to take care of their tools and make various appliances which will lighten their work. The material has been taken from The Practical Carpenter, and is a collection of ideas of practical men. Some of the devices may appear very simple and elementary, but the author does not hesitate to include them in the collection because of the possibility that they might in certain cases prove to be of the utmost value to the reader.

DYNAMOS AND MOTORS. A Text Book for Colleges and Technical Schools. By William Suddards Franklin, Professor of Physics, Lehigh University, and William Esty, Professor of Electrical Engineering, Lehigh University. New York: The Macmillan Company, 1909. 8vo.; 489 pp. Price, $4.

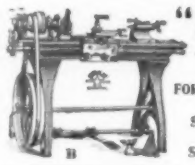
This is a physical treatise on dynamo-electric machinery, taking up the subject in five parts. The first deals with electric current, the dynamo and the transformer, and the measurement of direct current and alternating current. Part II deals with direct-current generators and motors. The theory of alternating currents is taken up in Part III, while alternating-current generators and motors form the fourth section of the book. The fifth part is devoted to the practical operation of dynamos and an explanation of switchboards and switchboard appliances. The book is primarily a text book adapted for the requirements of the student, and aims to give him a good basis of theory as well as a practical conception of the direct and alternating current dynamos and motors.

THEORY OF STRUCTURES. By R. J. Woods, M.E., M.Inst.C.E. London: Edward Arnold, 1909. 8vo.; pp. 276; 157 illustrations. Price, $3.

This new volume, although self-contained and independent of "The Strength and Elasticity of Structural Members," by the same author, forms a continuation of the previous work, suitable for very advanced students and draftsmen engaged in structural design. The elemental parts and formulæ of the former volumes are extended and utilized for a determination of the design of masonry and steel structures. Experience in the practical design of structures and a deepening sense of its importance has convinced the author of the great merit of presenting examples for study in a clear and intelligible form. Consequently a large part of this book has been given to the working out of practical examples. It is a very useful book for any engineer.

ONE THOUSAND WAYS AND SCHEMES TO ATTRACT TRADE. By Irving P. Fox and B. A. Forbes. Boston: The Spatula Publishing Company. Small quarto. 203 pp. Price, $1.

This little book is filled with some of the best schemes for attracting retail trade which we have ever seen and it is well worth the price charged for it.



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Scientific American Supplements 1568 and 1569 present a helpful account of the making of concrete blocks by Spencer Newberry.

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Scientific American Supplements 1547 and 1548 give a resume in which the various systems of reinforced concrete construction are discussed and illustrated.

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Scientific American Supplement 1574 discusses steel for reinforced concrete.

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AND EACH BEARING THAT DATE

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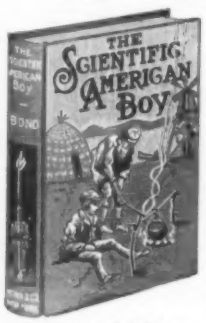

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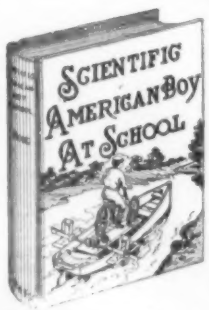

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A NEW ERA OF THE AMERICAN LOCOMOTIVE.

(*Concluded from page 100.*)

Atlantic type and the six-coupled type which succeeded it in fast passenger service. Commencing at the tender, which is of huge size in itself, we note that it is carried on two six-wheel trucks, a novelty in tender construction. The tank capacity is 4,000 gallons of oil and 12,000 gallons of water. The boiler, 6 feet in diameter, has 202 square feet of heating surface in the fire box, 3,275 square feet in the fire tubes, and 1,279 square feet in the feed water heater tubes, making a total of 4,756 square feet. In the superheating and re-heating section there are 1,121 square feet of tube surface.

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The boiler with its super-heater and feed water heater extension is connected rigidly to the frame in which are carried the pair of trailing wheels, the six-coupled drivers, and the high-pressure cylinders. The low-pressure cylinders, the forward truck and the four coupled drivers are carried in a separate frame, and the weight of the forward portion of the boiler, feed water heater, etc., is carried upon this forward truck by means of two sliding bearings which allow the frame to move laterally underneath the boiler, as the locomotive enters upon a curve. This necessitates employing a flexible steam pipe for conveying the steam from the re-heater to the low-pressure cylinders and the necessary flexibility is secured by using both slip and ball-and-socket joints in the steam pipe. Piston valves are used with both high and low-pressure cylinders, and the valve motions are of the Walschaert type. There are two high-pressure cylinders 24-inch diameter by 28-inch stroke, and two low-pressure cylinders 38-inch diameter by 28-inch stroke. The driving wheels are all 73-inch diameter.

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It is no exaggeration to say that these locomotives mark a new era in American locomotive practice; for although the Mallet system, super-heating, feed-water heating and compounding have been tried out separately on various locomotives, this is the first time that these refinements have been embodied so completely on a single type.

HOW AN AMATEUR CAN FIND HALLEY'S COMET.

(*Continued from page 102.*)

it. It appeared like any one of the many faint stars in the field of view. I should think it was about the eleventh magnitude on November 30th. The ephemeris makes it a little fainter, but as stated in the SCIENTIFIC AMERICAN

(*Concluded on page 114.*)

Home-Made Experimental Apparatus

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(Continued from page 113.)

lately, it has been growing brighter quite rapidly of late.

In looking for a comet one must not be too credulous, and think that the first object he sees is a comet. Many times I thought I had found the comet and could see even the tail, but it proved to be merely a star elongated by the shaking of the telescope.

Now the same manner of proceeding may be applied when the comet is near any other star, though it will not soon be so desirably located as on the evening of November 30th. After the comet is bright enough so one can see its tail and head, one would not need to go to so great trouble, but could systematically search a limited and definite area near it, and in a short time would be able to pick it up. But it is not expected that it will be a very conspicuous object in a small telescope before the close of winter or early spring. In the meantime the ambitious amateur astronomer can satisfy his interest by studying it in this manner.

As an aid to those who may wish to try this plan, it may be observed that the evening of February 5th is favorable because of the comet's proximity to Epsilon Piscium. Epsilon Piscium is in R. A. 0 hr. 58 min., and Dec. 7 deg. 24 min. From the ephemeris given for February 5th the following is its location on that evening: R. A. 0 hr. 57 min., and its Dec. +8 deg. and 11 min. Similarly it will be found close to Delta and 62 Piscium on February 17th, and March 5th it will be just north of 51 Piscium. Its motion is much slower during February than for the two preceding months, and so its location ought to be an easy task for the evenings immediately before and after these dates.

Where the neighboring star is not as conspicuous, as in the case of Aldebaran, one must study the constellation and familiarize himself with the stars in it until he can locate the desired star. This is often somewhat tedious, as a few weeks ago, when I tried to locate it among the many small stars in Taurus directly above Orion. It is, however, a helpful study for the amateur.

I had a very gratifying and profitable study on the evening of January 14th, as may be seen by the cuts. January 13th was the evening of nearest approach to Omicron Piscium, but as this was a cloudy night I decided to try the following night. I had searched but a moment or two when it appeared in view. I have seen it two or three times since November 30th, but it has never appeared so distinctly as on this evening. It is still faint, though but a few seconds of arc in size, and could be easily passed over if the observer is not careful. It looked more like a small nebula. I could not state definitely, but it appeared as though it had a faint nucleus. But the most gratifying result of the evening's study was the unmistakable motion detected as is clearly shown in the cuts. Stars *A* and *B* were about twenty minutes of arc apart. The amount of motion could not be determined accurately with the 45-power, and the comet is still too dim to use the higher powers. I have had no further opportunity as yet to pursue this phase of the study, but shall at the earliest possible moment. It will suggest a problem for other amateurs. I anticipate for many other amateurs as much delight in the scrutinizing of Halley's comet as I have already had.

It is estimated that the German Empire has nearly 35,000,000 acres of forest, of which 31.9 per cent belongs to the State. German forestry on scientific lines has resulted in raising the average yield of wood per acre from 20 cubic feet in 1830 to 65 cubic feet in 1904. During the same period it has trebled the proportion of the sawn timber secured from the average cut. In fifty-four years it increased the money returns from an average acre of forest sevenfold, yet to-day the forests are in better condition than ever before.

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Handy Man's Workshop and Laboratory

Compiled and Edited by A. RUSSELL BOND

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EVERY practical mechanic, whether amateur or professional, has been confronted many times with unexpected situations calling for the exercise of considerable ingenuity. The resourceful man who has met an issue of this sort successfully seldom, if ever, is averse to making public his methods of procedure. After all he has little to gain by keeping the matter to himself and, appreciating the advice of other practical men in the same line of work, he is only too glad to contribute his own suggestions to the general fund of information.

About a year ago it was decided to open a department in the Scientific American devoted to the interests of the handy man. There was an almost immediate response. Hundreds of valuable suggestions poured in from every part of this country and from abroad as well. Not only amateur mechanics, but professional men as well were eager to recount their experiences in emergencies and offer useful bits of information. Ingenious ideas, wrinkles or "kinks," as they are called. Aside from these, many valuable contributions came from men in other walks of life—resourceful men, who showed their aptness at doing things about the house, in the garden, on the farm. The electrician and the man in the physics and chemical laboratory furnished another tributary to the flood of ideas. Automobiles, motor cycles, motor boats and the like frequently call for a display of ingenuity among a class of men who otherwise would never touch a tool. These also contributed a large share of suggestions that poured in upon us. It was apparent from the outset that the Handy Man's Workshop Department in the Scientific American would be utterly inadequate for so large a volume of material; but rather than reject any really useful ideas for lack of space, we have collected the worthier suggestions, which we present in the present volume. They have all been classified and arranged in eight chapters, under the following headings:

I. Fitting up a Workshop; II. Shop Kinks; III. Soldering of Metals; IV. The Handy Man in the Factory; V. The Handy Man's Experimental Laboratory; VI. The Handy Man's Electrical Laboratory; VII. The Handy Man About the House; VIII. The Handy Sportsman; IX. Model Toy Flying Machines. Index.

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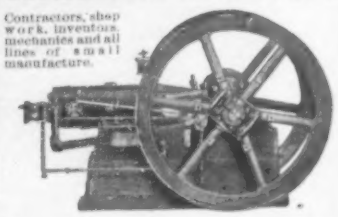

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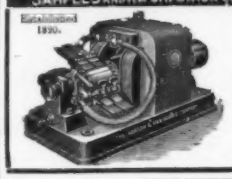

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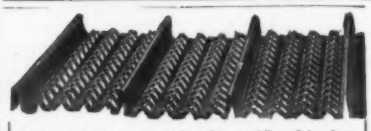

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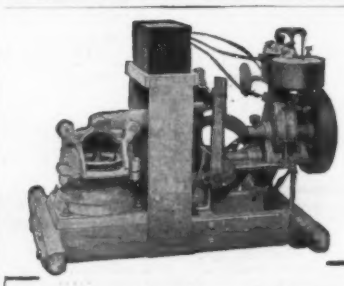

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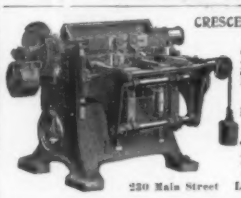

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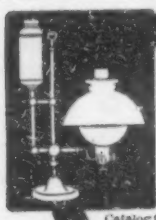

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